

# **ISAM/IPAC-RS Joint Workshop**

## **New Frontiers in Inhalation Technology**

In conjunction with ISAM congress

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**Saturday, June 3, 2017**  
**Santa Fe, NM**



**IPAC-RS**

# USER PERSPECTIVES ON INNOVATION IN INHALERS

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# Objectives

- Examine the benefits and challenges of new technologies or device add-ons from the perspective of patients and other users

# Givens

- Inhaler technique is inadequate
- Inhaled therapies often require more than one device and more than one technique
- Few providers start therapy by first considering patient ability or device preference
- Switching devices is not trivial

# Digitized respiratory disease

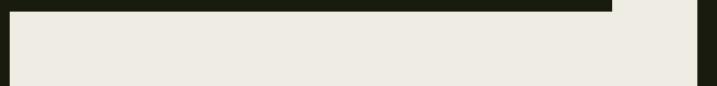
- Transferable or embedded systems
  - *Reminder systems*
  - *Smart sensors*
    - Use
      - *Records dose taken (time and date stamp)*
      - *Inhaler shaken*
      - *Flow detected by pressure changes/acoustic sensors*
      - *Location*
    - Technique instructions
- Connected devices
  - *Smart sensor data*
  - *Gather patient-reported data*
  - *Link to education/support*
  - *Push alerts*
  - *At the individual level may help patient, payer and provider to identify patterns*
  - *BIG data*
    - Population health
    - Personalized medicine

# WILL SMART TOOLS AND ADD-ONS WORK FOR ME?

# Will it make my job easier?

- Health care professionals are looking for technology to
  - *Replace or support education*
  - *Support self-management*
  - *Monitor adherence*
  - *Provide aggregated, easily digestible and actionable data only when wanted*
  - *Help meet quality standards*

# HOW DOES THE TECHNOLOGY MAKE ME FEEL?



# Will it make my job easier?

- Patients and families want technology to
  - *Be embedded*
  - *Be intuitive*
  - *Be tailored*
  - *Support self-management*
    - Reminders and counters
    - Push alerts
    - Education
  - *Track relevant, comprehensible and actionable data points IF they opt in*

ARE DEVELOPERS AND  
USERS ON THE SAME  
PAGE?

# Digital self-management systems face challenges to acceptance: Health care professionals

- Co-production is lacking
  - *Data not most clinically relevant*
- Interoperability across different health economies and clinical decision-making systems
- Inability to select from a menu of interoperable components
- Paucity of research to demonstrate efficacy/effectiveness

# Digital self-management systems face challenges to acceptance: Patients and families

- Co-production is lacking
  - *Short engagement lifespan*
- Inability to select from a menu of interoperable components
- Distrust data or characterize monitoring as punitive and/or intrusive
- “Alarm” and/or “data” fatigue
- May not foster behavioral change or behavioral intentions
- Patients with comorbidities prioritize needs based on whatever symptom(s) most pressing

# ACCEPTABILITY OF DIGITIZED ASTHMA AND COPD



# Acceptability to health care professionals

## Cautiously optimistic

- Supports early intervention and follow-up (facilitated by alert system)
- Fosters tailored patient education
- Increased nursing autonomy

## Worried about

- Time burden
- Liability
- Clinical relevance of data
- No direct interface with existing clinic systems
- Data dumping
- Quality of patient care; patient isolation
- Conflict with decision-support recommendations

# Acceptability to asthma patients

- My Air Coach

- *75% of people with asthma are willing to carry and use a connected device*

- Propeller

- *256 exit surveys (52% of subjects)*
    - 86% of adults and 84% of children with asthma found reports useful
    - 59% of those in the active intervention reported learning about new triggers
      - Merchant et al JACI 2016

- R44 HL127826

- *9/11 teens wanted to use program outside the study*
    - Checklists completed via the app were more likely to be completed every day
    - All found email reminders helpful and 1/3 wanted additional reminders

# Acceptability to COPD patients

- Little data on acceptability specific to COPD patients
- Lessons learned from telehealth
  - *Majority accept referral and find that technology helps disease management but...*
  - *A significant number refuse to accept telemedicine or are dissatisfied with their telemedicine experiences*

# USERS EXPERIENCE WITH TECHNOLOGY



# Acceptability to COPD patients: Lessons learned from dissatisfied telehealth (TH) users or refusers

- Resists technology
  - *Low self efficacy*
  - *Anxiety*
    - Can't be assuaged
      - *Sander et al BMC Health Services Research 2013*
- Believes TH threatens access to, or relationship with, providers
  - *Loss of seeing/speaking with providers*
  - *Worry about provider burden*
    - *Sander et al 2013*
- Resists change
  - *Finkelstein Telemedicine Journal & E-Health 2004*
- Has physical limitations
  - *Dexterity*
  - *Vision*
- Perceives as threat to privacy or identity
- Fears equipment malfunction and/or inaccurate directions

# Practical considerations in pediatric studies

**Table 5** Broken, forgotten and lost devices

	<b>Intervention (47 participants)</b>	<b>Control (42 participants)</b>
Device reported as 'broken' by child	23 (50%)	8 (19%)
Devices damaged beyond repair (when inspected by study team, requiring replacement device)	17 (37%)	2 (5%)
Participant forgot to bring device to clinic	10 (22%)	18 (43%)
Device lost completely	5 (11%)	2 (5%)

# Practical considerations in adult studies

- Smartinhaler trial of 303 patients over 24 weeks
  - 95% *complete data*
  - 98% *returned monitors*
    - 51 experienced water immersion
    - 93 were lost or thrown away

# Acceptability

- Opt in
  - *Patient sets limits on how closely they are monitored*
  - *Expectation of privacy r/t potentially sensitive information*

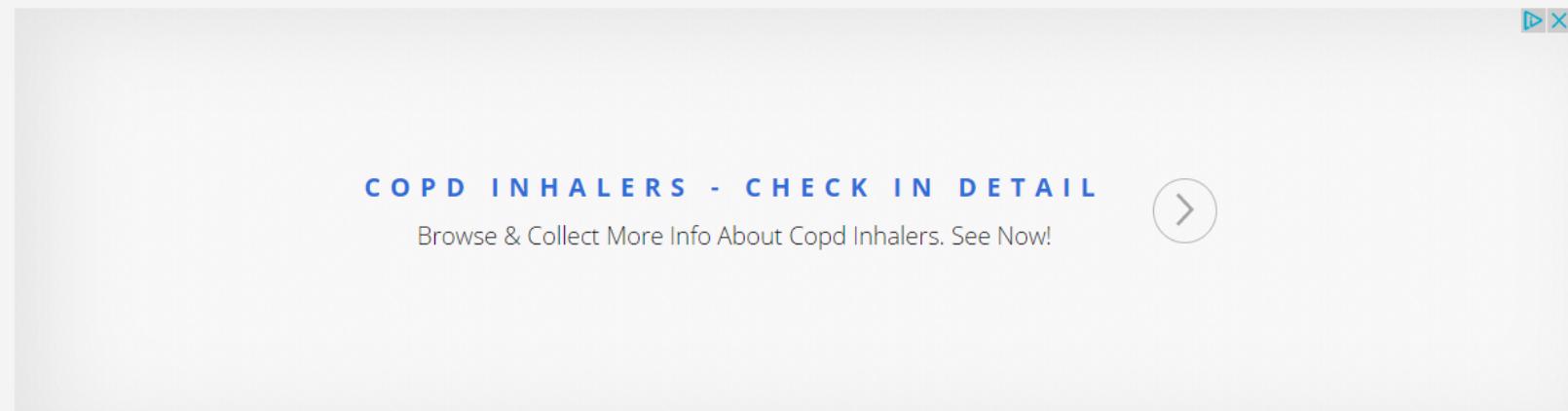
Your inhaler's watching y × Home - PubMed - NCBI Maureen

www.foxnews.com/health/2016/07/20/your-inhalers-watching-drugmakers-race-for-smart-devices.html

bombers intercepted off Alaskan coast car crash triggers massive explosion right for your lifestyle? order on aluminum imports on floating humpback whale carcass

# FOX NEWS Health

Home Video Politics U.S. Opinion Business Entertainment Tech Science Health Travel Lifestyle World On Air



## COPD INHALERS - CHECK IN DETAIL

Browse & Collect More Info About Copd Inhalers. See Now!



[Health Home](#) Men's Health Women's Health Children's Health Alternative Medicine Diabetes Heart Health Nutrition & Fitness

### RESPIRATORY HEALTH

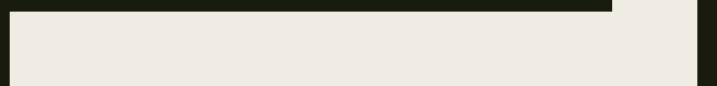
# Your inhaler's watching you: Drugmakers race for smart devices

ARE THE NEW TOOLS AND  
ADD-ONS REALLY GOING  
TO HELP?

# Is innovation helping?

- Limited data on efficacy; less (none?) on effectiveness
- More benefit expected with more interaction
  - *More interaction means greater burden so fewer will engage*

# INNOVATION WISH LIST



# Health care professionals' improvement list

- Predictive models to differentiate between happy adopters and refusers/malcontents
  - *Tailored interventions to increase uptake and satisfaction*
- More qualitative data on how patients manage their disease
  - *Allows early intervention or additional education*
- Integration across systems
  - *Innovations simplify clinical care*
- Ability to track adherence reliably
  - *Training in behavioral science to respond effectively*

# Patients' improvement list

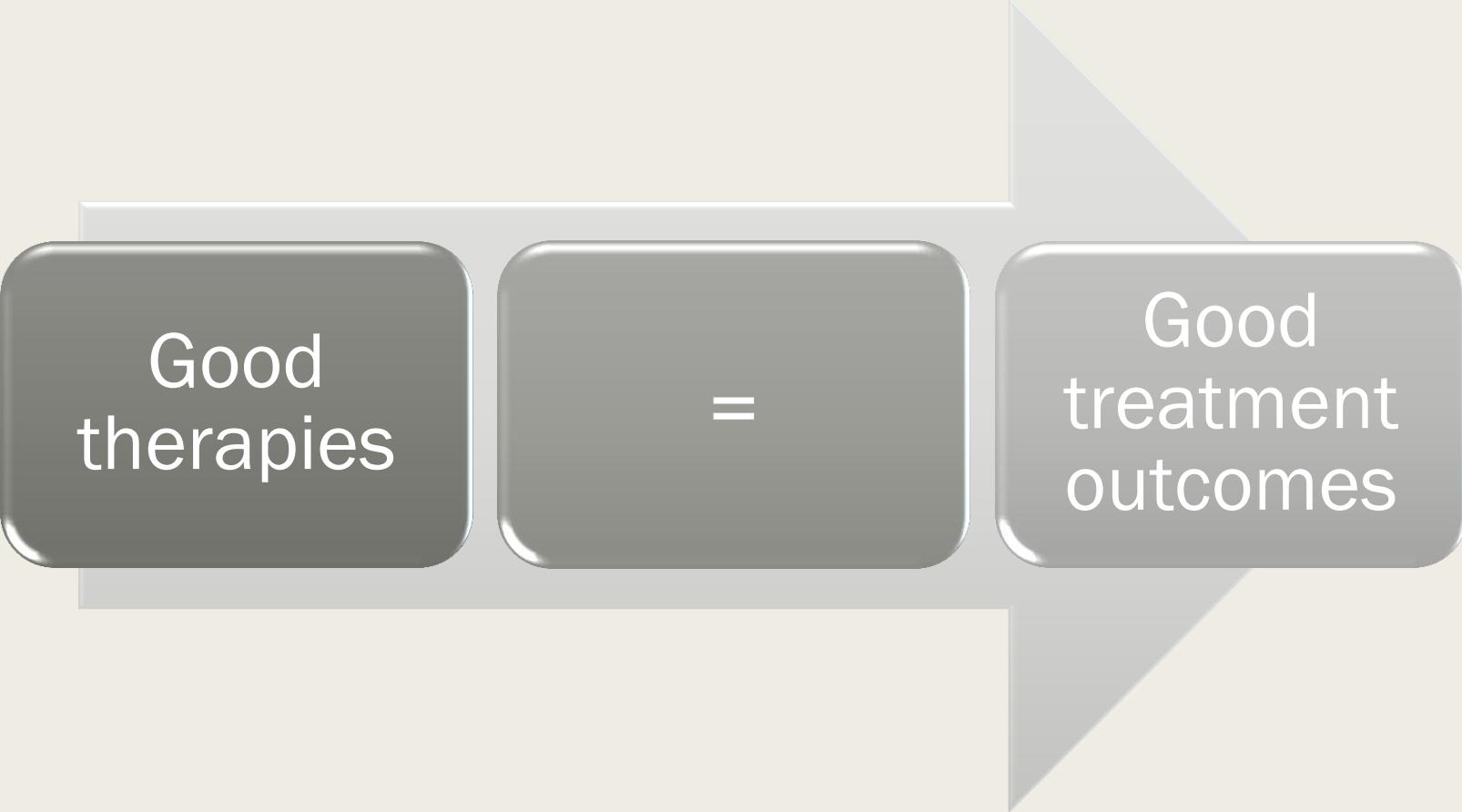
- Embedded intuitive technology
- Innovations simplify and support self-management
- Technology fosters engagement with, not replacement of, the health care team
- Tracking empowers not punishes
- Innovation motivates
  - *Engagement ≠ motivation*

# WHAT IS MISSING?



# The process of adherence is missing

- Health care professionals need to
  - *Understand the many reasons for non-adherence*
  - *Engage in patient-centered therapeutic communication around technology to decrease refusals and increase satisfaction*
  - *Use care models that support shared decision-making*
  - *Use innovative approaches to motivate patients to engage in self-care*



Good  
therapies

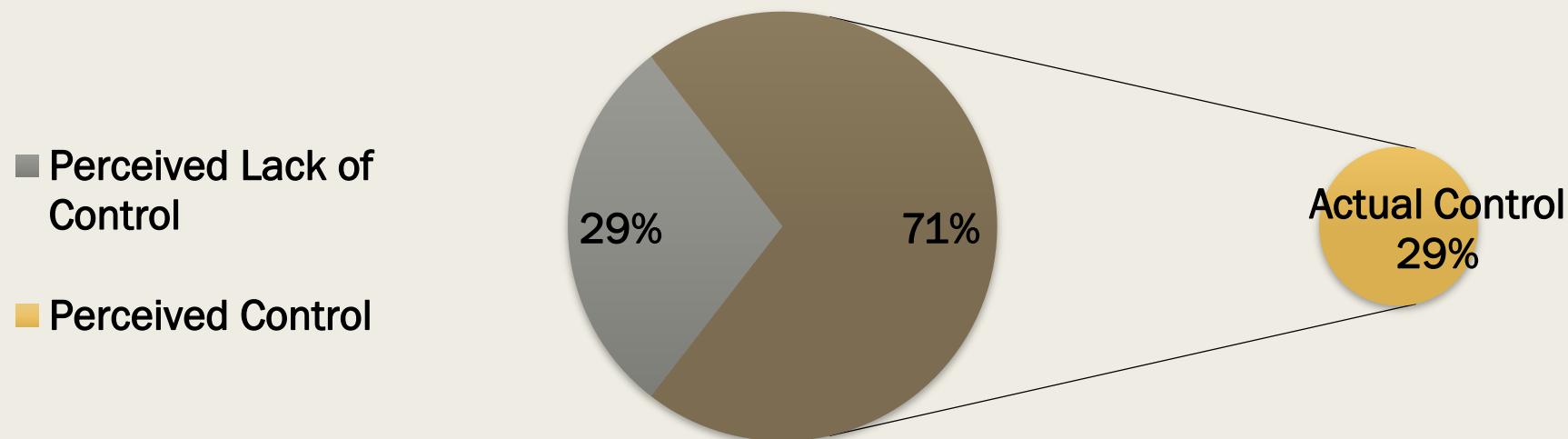
=

Good  
treatment  
outcomes

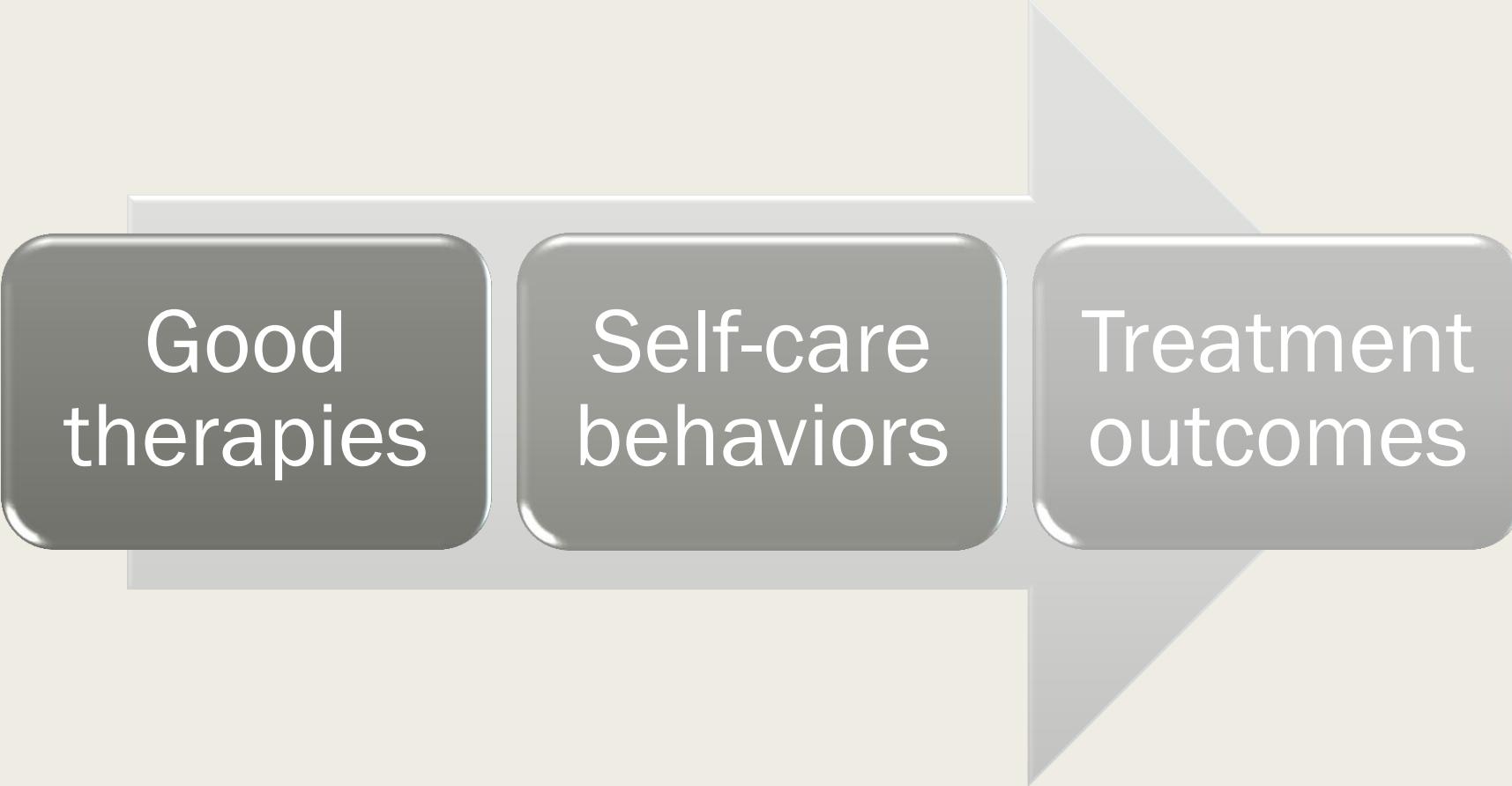
The diagram consists of three rounded rectangular boxes arranged horizontally. The first box on the left contains the text 'Good therapies'. The second box in the middle contains the symbol '='. The third box on the right contains the text 'Good treatment outcomes'. A large, light-grey arrow points from the first box to the third box, passing over the second box.

Good  
treatment  
outcomes

# Perceived vs. actual asthma control



AIM study, 2009



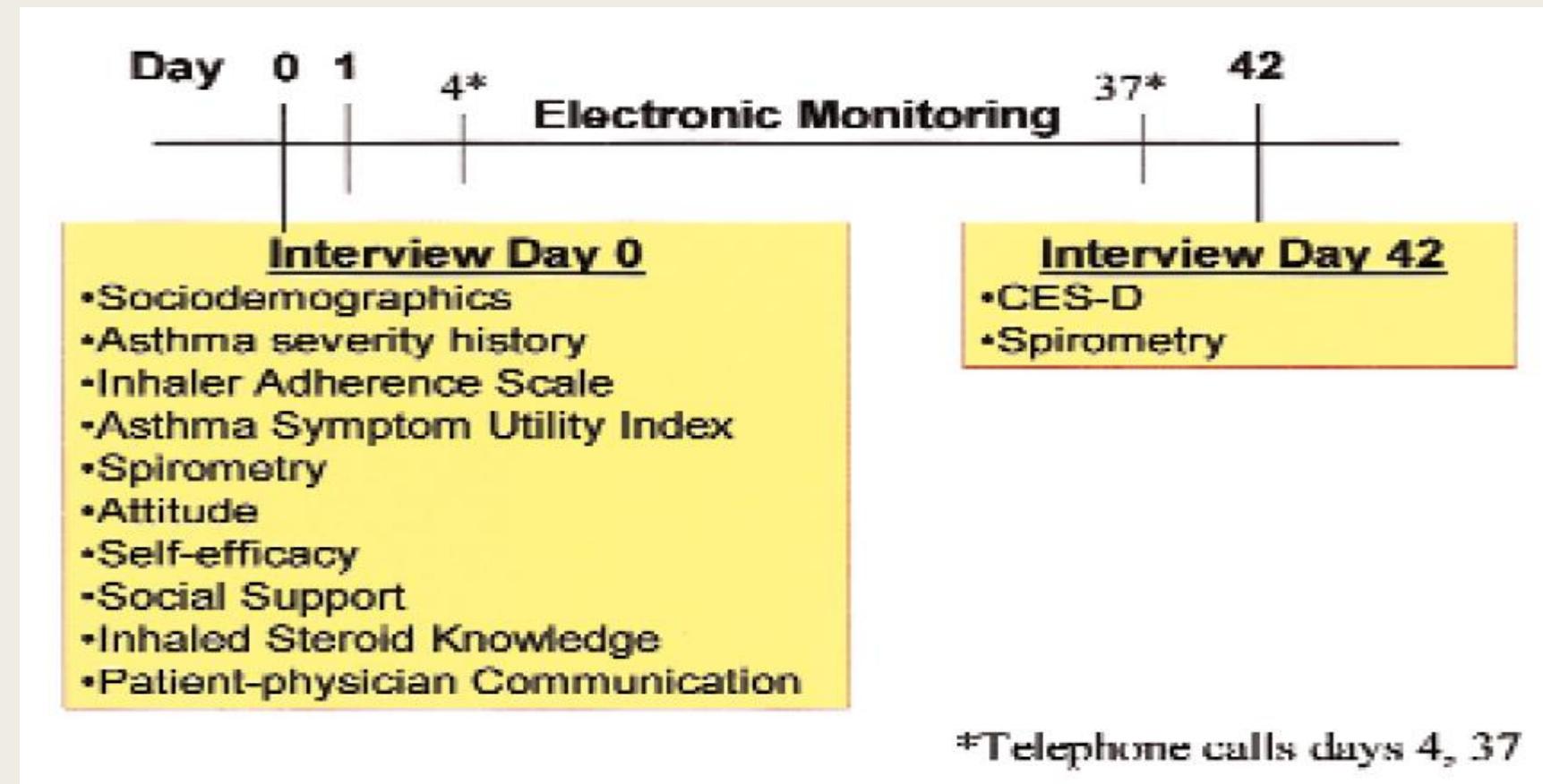
Good  
therapies

Self-care  
behaviors

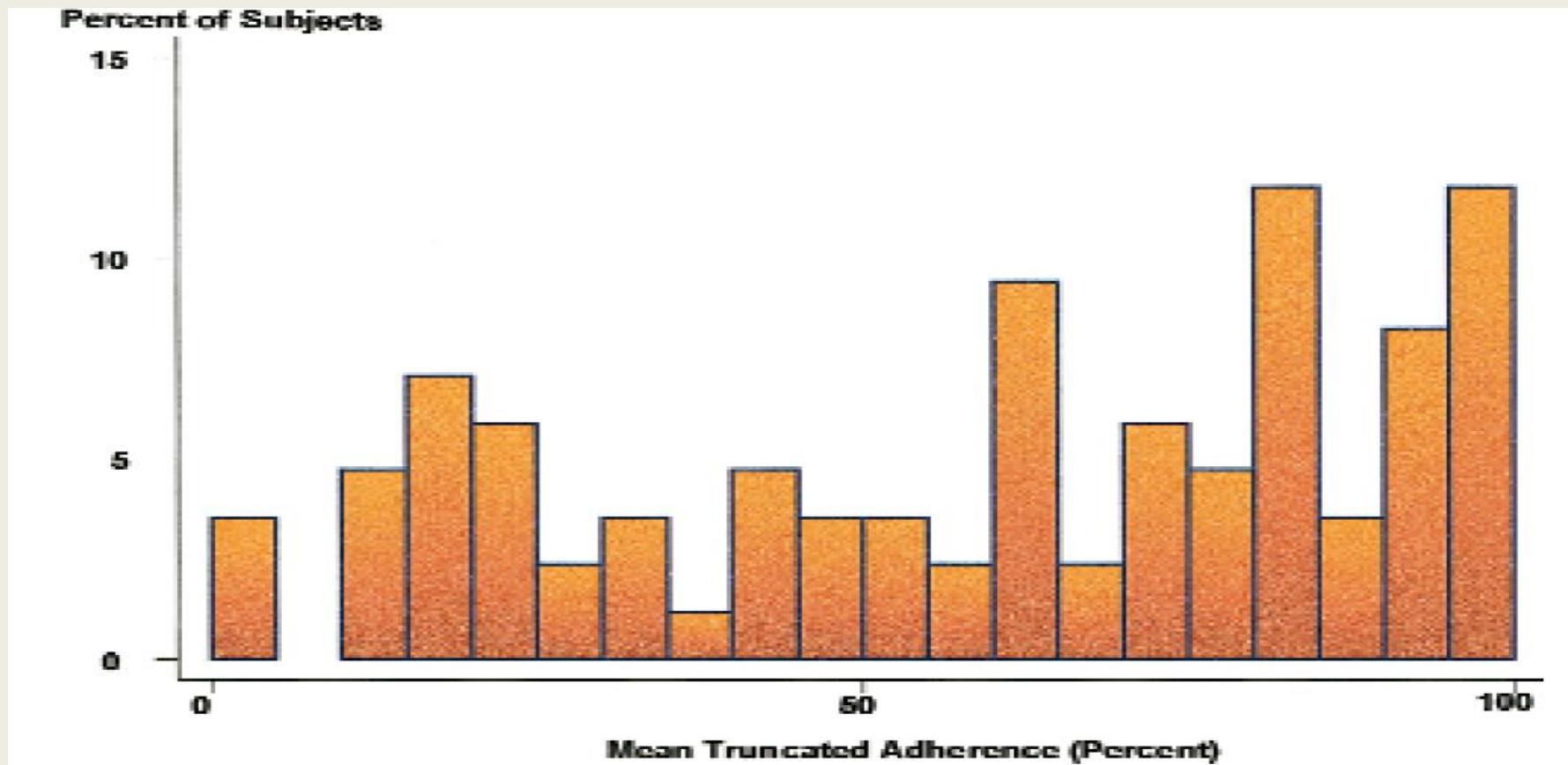
Treatment  
outcomes



**MDI Log**



# Mean truncated adherence 60%



Apter, Boston, George et al Journal of Allergy and Clinical Immunology 2003

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graph LR; A[Motivate] --> B[Self-care behaviors]; B --> C[Treatment outcomes]
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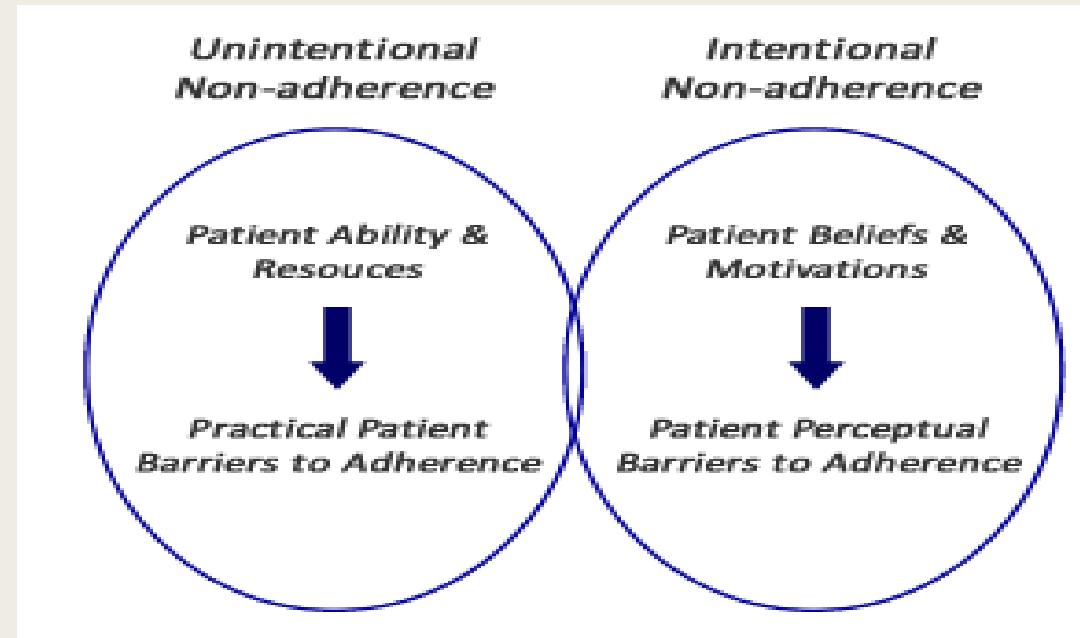
Motivate

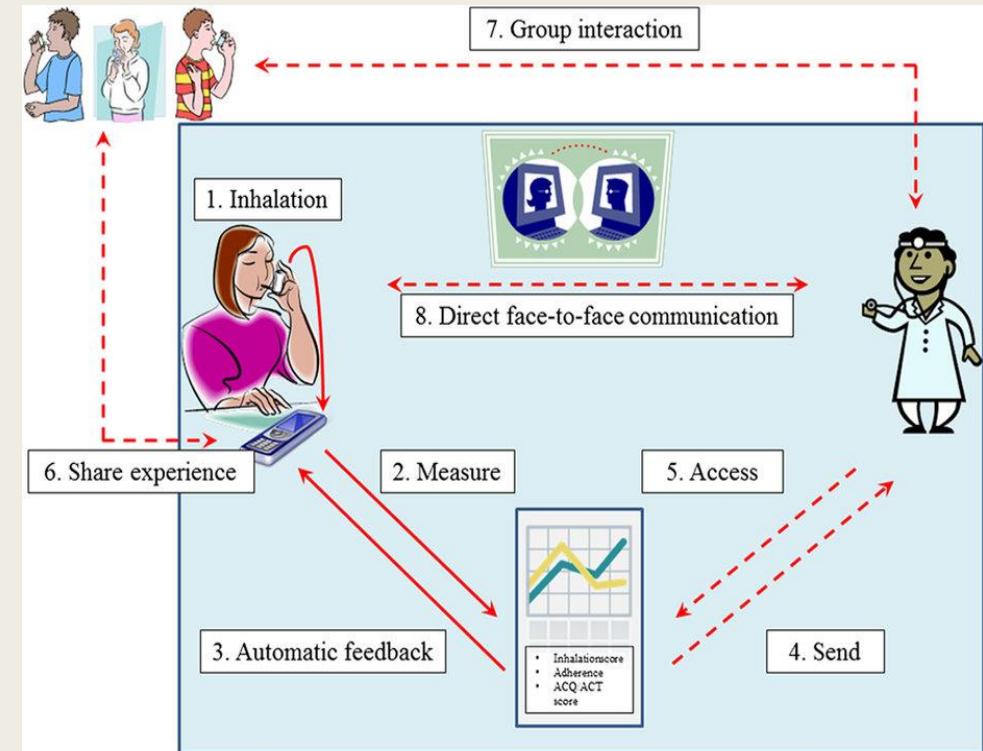
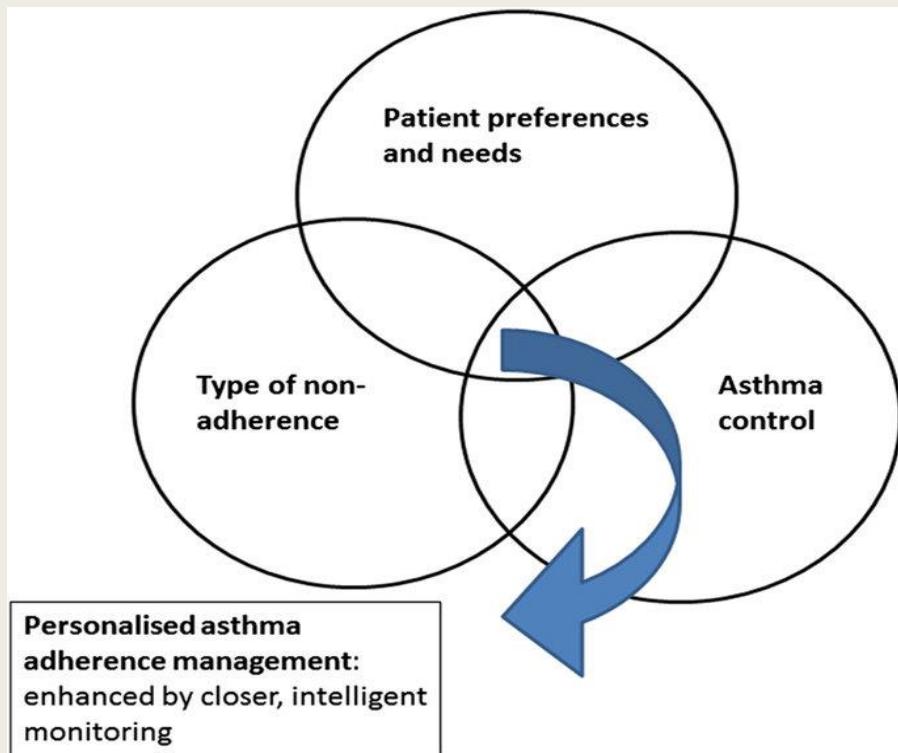
Self-care  
behaviors

Treatment  
outcomes

# Adherence is more than an outcome

- Smart inhalers focus on health behavior outcome (adherence), not process



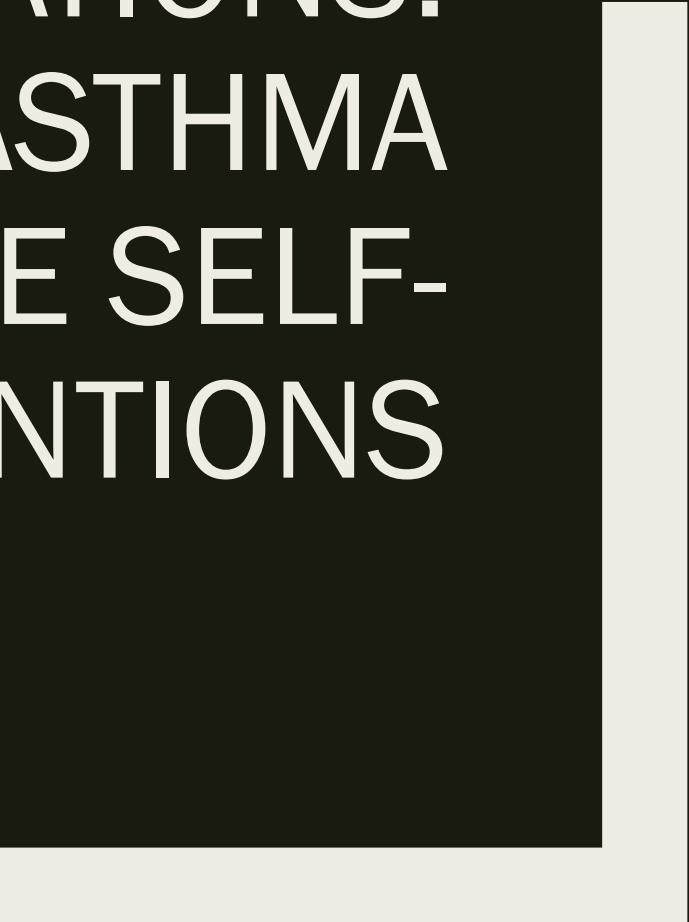


	<i>Direct biochemical measurement</i>	<i>Judgment by healthcare provider</i>	<i>Patient self-report</i>	<i>Prescription refill data</i>	<i>Electronic monitoring devices</i>
Continuous measure of adherence					
Objective/unbiased					
Costs					
Confirmation of intake					
Detects erratic non-adherence					
Detects intelligent non-adherence					
Detects unwitting non-adherence					
Relates non-adherence to asthma control					

# Behavioral intentions best predictor of actual health behaviors

- Self-management begins with an understanding of the rationale for the self-management actions needed
- Comprehension and interpretation of asthma status (ACQ and PFTs) may present a rationale for **why the patient should self-manage.**
- Preliminary evidence shows that well-designed infographics can create behavioral intentions

# INFORMATION VISUALIZATION INNOVATIONS: UNDERSTANDING ASTHMA STATUS TO ACTIVATE SELF- MANAGEMENT INTENTIONS



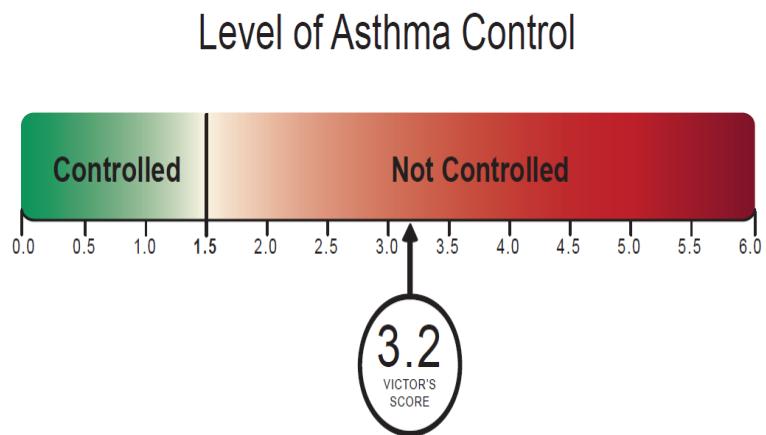
# Focus groups

## Asthma Control Report

Patient: Victor Benson

Date: April 2, 2017

Provider: J. Gordon, FNP



- Put this on my inhaler
- I wouldn't need to see my doctor if I knew this
- You wouldn't have to worry about understanding what the doctor was telling you if you had this

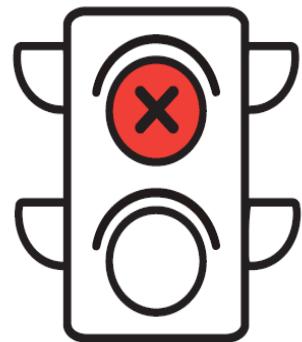
# ACQ infographics

## Asthma Control Report

Patient: *Victor Benson*

Date: *April 2, 2017*

Provider: *J. Gordon, FNP*



Victor's asthma is:  
**NOT CONTROLLED**

Control Score: **2.7**

0 = totally controlled  
6 = extremely poorly controlled

- You're dead
- Nothing you can do
- Might as well give up

# ACQ infographics

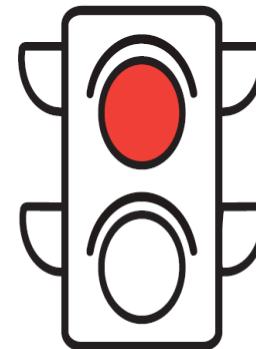
- Stop messing around
- Stop what you're doing wrong and start doing what you're supposed to do

## Asthma Control Report

Patient: *Victor Benson*

Date: *April 2, 2017*

Provider: *J. Gordon, FNP*

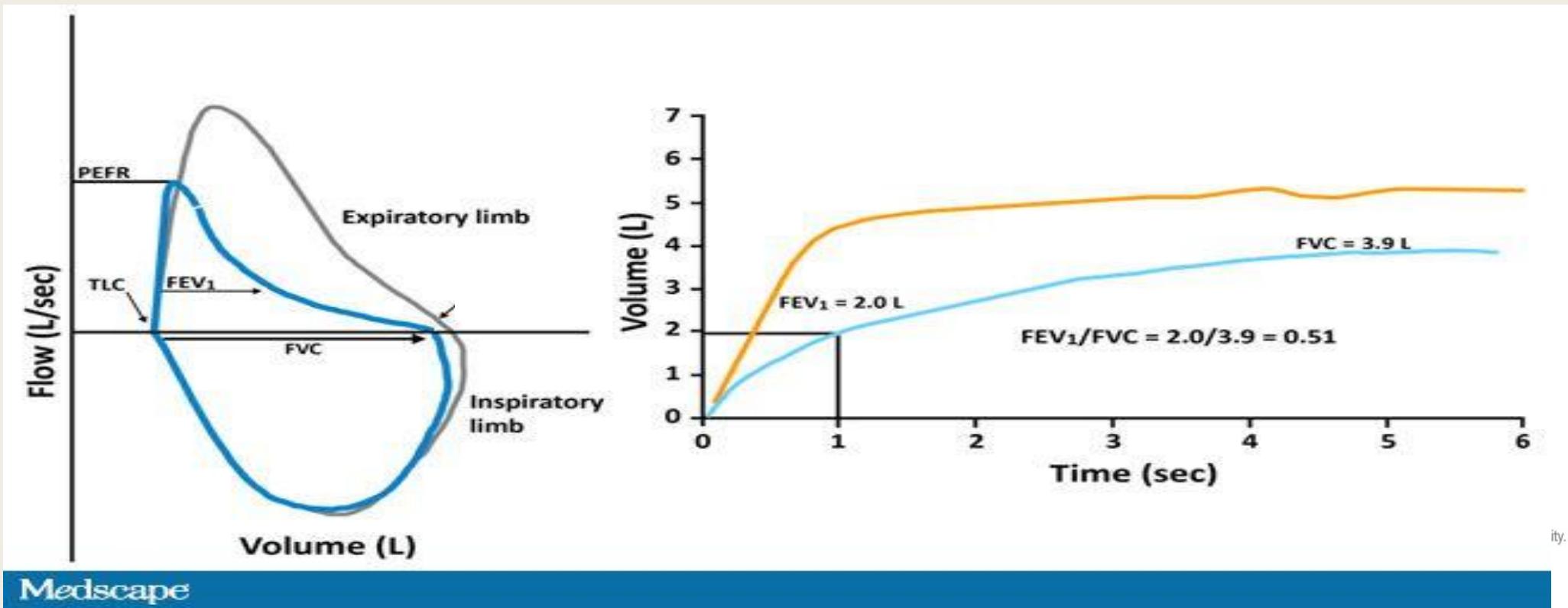


Victor's asthma is:  
**NOT CONTROLLED**

Control Score: **3.2**

0 = totally controlled  
6 = extremely poorly controlled

# PFT infographics



# Smart tools and add-ons: Summary

- To be accepted
  - *Make the job of being a patient or health care professional easier*
    - Anticipate and manage resistance
  - *Opt in*
  - *Foster engagement between the user and the health care team*
  - *Co-produced with patients and health care professionals*
  - *Technology empowers not punishes*
- Innovation must support the process of self-care and not just measure the outcome
  - Motivation for self-care requires more than just data