A Research Journey to Improve Outcomes of Patients with Chronic Heart Failure

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CNS, Kaufman Center for Heart Failure
Objectives

• Discuss my experiences in nursing research related to management of heart failure
  – The good, the bad
  – Mistakes and ah-ha moments

Disclosures

• None, related to this presentation
My Research Journey - 2 Paths

Nurses

Patients
Nurses Caring for Pts. with HF

• Nurses *knowledge about* heart failure self-care principles
• Nurses *comfort in* educating patients about heart failure self-care principles
• *Frequency in* which hospital nurses educate patients about heart failure self care principles
Clinical Experiences Shaped New Research

• In 1999.... was discussing self-care principles in heart failure with nurse leaders and educators (hospital & home care):
  – Developing a HF handbook
  – Calcium channel blockers
  – Physician failure to respond to home care nurse concerns
Clinical Experiences Shaped New Research

• Clinical influences by patients:
  – When delivering education, listened to messages from patients:
    – Rinses canned corn and hotdogs
    – Eating watermelon when on a tight fluid restriction
    – Guessing Na+ intake
    – Does not follow diet plan when eating out
    – Ate out 3-4 days/week
Clinical Experiences Shaped New Nursing Knowledge

• Completed a RoL (1999)
• No reports on nurses knowledge of HF education principles
  – Physicians, administrators and nurses ASSUMED nurses:
    – Know what they are talking about when educating patients
    – Understand guideline-directed medical therapies content on self-care
Program of Research Evolved

• Developed a tool that measured nurses knowledge of heart failure self care principles
  – 20-items; Y/N response set
  – Checkbox if you want more info on topic
    – Content validity testing
  – Heart failure handbook team support; assisted in getting RNs to complete paper survey anonymously
Nurse’s Knowledge - 6 studies

- Fowler: N = 61*
- Kalowes: N = 157***
- Delaney: N = 94**
- Willette: N = 49***
- Washburn: N = 55***
- Albert: N = 300**,***

*, Community nurses
**, Home care nurses
***, Hospital nurses

85-87.5% pass rate

Translation: Developed RN Education Program - Mandatory for CICU, HF-ICU and Tele RNs
Discoveries Lead to New Research

• Unable to determine the depth and breadth of HF self-care knowledge on different themes with only 20 questions and Y/N responses
  – Needed to learn strengths and weak areas for each self-care theme to:
    – Develop focused interventions
    – Spend time and $ on interventions

Knowledge ≠ Action
Discoveries Lead to New Research

Comfort and frequency in delivering education

- **Comfort scale:** 1, *completely uncomfortable* to 7, *completely comfortable* (standardized to 0-100)
- **Frequency scale:** 0, *never*; 10, *always* (0-100%)

8 themes; 44 items:
- Medications (10 items)
- Low sodium diet (7 items)
- Activity/exercise (6 items)
- Fluid restriction (3 items)
- S/Ss of worsening condition (4 items)
- Daily weight monitoring (4 items)
- S/S of fluid overload (4 items)
- HF illness beliefs (6 items)
Heart Failure Hospital Nurses Need HELP to Educate Patients

Typical Amount of Time Spent Providing HF Discharge Education

- Time, minutes; N = 118

- 43.5%

## RESULTS

<table>
<thead>
<tr>
<th>Comfort Factor*</th>
<th>n</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>118</td>
<td>81.4 (11.3)</td>
</tr>
<tr>
<td>Weight monitoring</td>
<td>117</td>
<td>90.0 (12.0)</td>
</tr>
<tr>
<td>Signs/Symptoms of worsen condition</td>
<td>117</td>
<td>88.8 (11.8)</td>
</tr>
<tr>
<td>Signs/Symptoms of fluid overload</td>
<td>116</td>
<td>88.5 (12.2)</td>
</tr>
<tr>
<td>Fluid restriction</td>
<td>117</td>
<td>88.3 (12.7)</td>
</tr>
<tr>
<td>HF beliefs</td>
<td>117</td>
<td>83.2 (14.9)</td>
</tr>
<tr>
<td>Low sodium diet</td>
<td>117</td>
<td>80.0 (14.5)</td>
</tr>
<tr>
<td>Medications</td>
<td>117</td>
<td>78.0 (13.8)</td>
</tr>
<tr>
<td>Activity / exercise</td>
<td>117</td>
<td>73.0 (19.3)</td>
</tr>
</tbody>
</table>

* responses of comfortable or very comfortable

## RESULTS

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<tr>
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<tr>
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</tr>
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<td>Weight monitoring</td>
<td>117</td>
<td>90.0 (12.0)</td>
<td>S/S worsen cond.</td>
<td>116</td>
<td>71.5 (29.0)</td>
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<tr>
<td>S/S worsen cond.</td>
<td>117</td>
<td>88.8 (11.8)</td>
<td>S/S fluid overload</td>
<td>116</td>
<td>70.1 (30.5)</td>
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<tr>
<td>S/S fluid overload</td>
<td>116</td>
<td>88.5 (12.2)</td>
<td>Weight monitoring</td>
<td>117</td>
<td>69.8 (29.8)</td>
</tr>
<tr>
<td>Fluid restriction</td>
<td>117</td>
<td>88.3 (12.7)</td>
<td>Fluid restriction</td>
<td>116</td>
<td>68.5 (29.2)</td>
</tr>
<tr>
<td>HF Beliefs</td>
<td>117</td>
<td>83.2 (14.9)</td>
<td>HF Beliefs</td>
<td>117</td>
<td>59.9 (29.4)</td>
</tr>
<tr>
<td>Low Na+ Diet</td>
<td>117</td>
<td>80.0 (14.5)</td>
<td>Medications</td>
<td>116</td>
<td>56.8 (25.5)</td>
</tr>
<tr>
<td>Medications</td>
<td>117</td>
<td>78.0 (13.8)</td>
<td>Low Na+ Diet</td>
<td>117</td>
<td>48.0 (29.2)</td>
</tr>
<tr>
<td>Activity/Exercise</td>
<td>117</td>
<td>73.0 (19.3)</td>
<td>Activity/Exercise</td>
<td>117</td>
<td>42.7 (29.4)</td>
</tr>
</tbody>
</table>

Cond., condition; S/S, signs/symptoms; *, responses of comfortable or very comfortable **, completed 70-100% frequency

TRANSLATION of EVIDENCE

Many interventions:
• Revised patient “HF handbook”
  – Added “how to” details in self care
• Revised videos; included more self-care content
• PharmD's: 1:1 hospital medication review
  – 2x for patients discharged
• CNS, PharmD and dietician-led group HF classes
  – 3x/week
• 1 pg HF “zones” pt. handout w a toll free phone line
• Mandatory RN on-line education module
  – Focus: diet, medication, activity/exercise and weight monitoring
• 2 of 9 recommendations to clinicians:
  • Ensure qualified and trained HF nurse/other providers deliver HF services
  • Allot adequate time in hospital and post-discharge to deliver complex interventions and assess patient and caregiver responses
Patients:

• RCT: video education
• Comparative study: Common Sense Model of Illness Beliefs to educate patients pre-discharge
• RCT (pilot): 1000 mL fluid restriction x 6 weeks post discharge
• RCT (pilot): “Code RED” on adherence to 7 day follow-up appointment
• Descriptive research: Factors of activity/exercise non-adherence
• Correlation research: Whole body impedance and PAWP
• RCT: Innovative discharge intervention to ↓ 30-day readmission
Video Education Discoveries

• Single center, RCT
• Some patients randomized to video education never even took the plastic wrap off the video
• No change in healthcare consumption between groups
• Video patients had:
  – Greater sign/symptom reduction ($P < 0.04$)
  – Edema ($P < 0.01$) and fatigue ($P < 0.01$)
  – Initiated more actions for edema ($P < 0.05$) and dyspnea (both $P < 0.01$)
  – Higher mean self-care behavior score ($P < 0.01$), reflecting ↑ self-care adherence

Pt Education using the CSM

Comparative study (2 group, pre-post design)

• 244 subjects; 6 month follow-up

• Multivariate results:
  – Hospitalization:
    – Fewer 1st hospitalizations for decompensated HF
      – OR (95% CI): 0.54 (0.31, 0.97), \( p=0.039 \)
    – No differences in all hospitalization, hospitalization for HF or hospital LOS
  – ED care:
    – Fewer ED visits d/t HF decompensation
      – OR (95% CI): 0.29 (0.13, 0.62), \( p=0.001 \)
    – Unplanned office visits for HF care
      – No differences between groups

Fluid Restriction – Is it Independently Meaningful?

• Fluid restriction may be easier to manage than following a strict low sodium diet
  – Can develop easy systems of measuring and monitoring fluid intake
  – Can quench thirst with hard candy & suckers
  – No reading labels and counting sodium content

• Randomized, controlled pilot study
  – Patients followed x 6 weeks post discharge
  – Usual care, n= 26
  – Intervention group, n= 20

Physicians: fluid torture

## SALT-HF RESULTS

<table>
<thead>
<tr>
<th>Change in QoL Scores</th>
<th>1 Liter Group</th>
<th>Usual Care Group</th>
<th>P Value**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Limitations</strong></td>
<td>-16.7 (-32.5, -8.8)</td>
<td>-2.1 (-19.3, -14.4)</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Symptom Frequency</strong></td>
<td>-31.2 (-45.3, -17.2)</td>
<td>-8.3 (-37.5, 2.1)</td>
<td>0.044</td>
</tr>
<tr>
<td><strong>Symptom Burden Sc.</strong></td>
<td>-33.3 (-56.2, -18.7)</td>
<td>0 (-25.0, 8.3)</td>
<td>0.025</td>
</tr>
<tr>
<td><strong>Total Symptom Score</strong></td>
<td>-32.3 (-52.1, -20.3)</td>
<td>-5.2 (-29.2, 4.2)</td>
<td>0.026</td>
</tr>
<tr>
<td><strong>Self-Efficacy Score</strong></td>
<td>0 (-25, 0)</td>
<td>0 (-21.8, 9.4)</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>QoL Score</strong></td>
<td>-25 (-41.7, -10.4)</td>
<td>-16.7 (-45.8, 12.5)</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Overall Summary Sc.</strong></td>
<td>-24.7 (-34.2, -11.9)</td>
<td>-6.7 (-29.1, 5.1)</td>
<td>0.050</td>
</tr>
<tr>
<td><strong>Clinical Summary Sc.</strong></td>
<td>-25.3 (-29.1, -12.4)</td>
<td>-6.7 (-24.5, 10.3)</td>
<td>0.044</td>
</tr>
</tbody>
</table>

*, Difference 60 D to baseline; **, Wilcoxon rank sum test

Fluid Restriction – Is it Independently Meaningful?

• Results:

![Clinical QoL Summary by Fluid Restriction Group](image)
Fluid Restriction – Is it Independently Meaningful?

• Results:
  – Signals of < ED visits and HF rehospitalization

More research is needed

HF Readmission in 30 Days 2007-2009; N=1,330,157

7 day-post discharge visit adherence rates were (< 50%)

13.4% of 30-day readmissions (Day 0 - Day 3)
31.7% of 30-day readmissions (Day 0 - Day 7)
61.0% of 30-day readmissions (Day 0 - Day 15)

329,308 rehospitalization; 24.8%

APN-Led RED Intervention

• “Code RED Card” pilot intervention
  – 3 education points + card w contact info, picture & visit info
    – *Risk*: early post-discharge vulnerable period
    – *Re-Evaluation*: need to assess if changes made in-hospital remain beneficial
    – *Readmission*: reduce return in 30 days
APN-Led RED Intervention

• “Code RED Card” pilot intervention

\[\downarrow\]

• Results: 77% (Intervention) vs. 40% (Usual care) show rates; \(p=0.01\)
  – Unknowns re important features of RED:
    – Card (contact info; knows who will be providing care)?
    – Belief that the person on the card was “waiting” for them to show?
    – 3 messages?
    – Individual attention to detail?

More research is needed.
Activity and Exercise in HF

HF-ACTION: poor intervention adherence

GOALS: >90 min/wk; [---------- > 120 minutes/week ---------]

# Subjects adhering to exercise duration goal

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Full adherence</th>
<th>Partial adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 months</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>10-12 months</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>22-24 months</td>
<td>40%</td>
<td>60%</td>
</tr>
<tr>
<td>25-36 months</td>
<td>30%</td>
<td>70%</td>
</tr>
</tbody>
</table>

(50% adherence)

HF-ACTION; N=959 Intervention Pts who were Event Free @ 3 Months

CV Mortality or HF Hospitalization

- Filled circles, adjusted logarithmic analysis, \(p<0.001\);
- Open circles, unadjusted analysis

Percent of Time Spent in Different Activity Modes Over 6 Days: in Chronic Stable HF

- **NYHA III**
  - Passive: 72%
  - Active: 17%
  - Walking: 9%
  - Fast walking: 1%

- **NYHA II**
  - Passive: 64%
  - Active: 17%
  - Walking: 14%
  - Fast walking: 3%

- **NYHA I**
  - Passive: 61%
  - Active: 14%
  - Walking: 16%
  - Fast walking: 4%

Daily total wearing time (min): 0 to 800

N=50

Activity and Exercise in HF

• When followed, activity and exercise improved primary outcomes
• Predictors of activity and exercise in HF were unknown
• Conducted a mixed-methods study
  —Qualitative study; 48 subjects, single center
  —Multicenter, international descriptive study; 6 sites
Seven Themes Related to Exercise Adherence (N=48; single site)

- Patients not knowing and physicians not telling
- Scared into doing or not doing it
- Life gets in the way
- Meaningful support versus meaningless talk
- Emotional connections to exercise
- Value did not always equal motivation to move
- Disconnection between self-confidence and actions

Patients not knowing and physicians not telling

What were you told by your doctor about exercising?

• Just very general things, “You should do this.”
• That I should start doing it. Nothing specific but, “Get out and walk.”
• They said, “You do whatever you want to do. If you don’t feel like doing it, don’t do it.”
• I think that on a gradual basis, it might strengthen my heart, but I’m not sure.
• My doctor said not to go overboard ‘cause my heart’s been compromised.
• To do what I felt like I could do and be comfortable.
• He kind of left it up to me to do what I wanted to do.
Since Instructions For Exercise were not Specific, Patients were not Clear on what “Exercise” Meant

- I am stretching my toes, my feet, and my arms and stuff like that
- I do some degree of isometric and stuff like that
- I walk to the grocery store and stuff like that. I walk the dogs out and chain them up
- It’s all stretch, isometric stretching...in my living room or bedroom or kitchen or outside or wherever I feel like doing it.
- Some walking...to the corner store and back... like 10 minutes or longer.

Because patients were not told specifically what to expect, they were sometimes scared to do it.

- I reckon if I exercise too much, I’d have a heart attack.
- You can get short of breath, or you get tired, or like you can get chest pains, something like that.
- I get scared sometimes ’cause of my heart rate.
- I don’t want to bring on a heart attack.
- When you’re short of breath, you stay away from anything that’s going to cause you to breathe fast or even faster.
- I’m afraid that walking will cause my heart to beat fast and I’ll be laying out on the sidewalk.

### Quantitative Component; N=492

<table>
<thead>
<tr>
<th>General Factors</th>
<th>N</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs; mean, SD</td>
<td>490</td>
<td>62.8 ± 13.55</td>
</tr>
<tr>
<td>BMI, mg/kg/m²; mean, SD</td>
<td>489</td>
<td>29.34 ± 6.73</td>
</tr>
<tr>
<td>Gender, male; n (%)</td>
<td>492</td>
<td>319 (64.8)</td>
</tr>
<tr>
<td>Lives with someone; n (%)</td>
<td>492</td>
<td>353 (71.7)</td>
</tr>
<tr>
<td>Caucasian; n (%)*</td>
<td>392</td>
<td>299 (76.3)</td>
</tr>
<tr>
<td>Highest education; n (%)</td>
<td>492</td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td></td>
<td>232 (47.2)</td>
</tr>
<tr>
<td>Some college-bachelors degree</td>
<td></td>
<td>200 (40.6)</td>
</tr>
<tr>
<td>Masters or doctorate degree</td>
<td></td>
<td>60 (12.2)</td>
</tr>
</tbody>
</table>

*, Not obtained in Swedish sample; n=100
## Odds of Moderate-Vigorous Exercise – of 18 Characteristics

<table>
<thead>
<tr>
<th>Factor; Level</th>
<th>OR</th>
<th>95% CI</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI; Quartiles</td>
<td>0.69</td>
<td>0.53, 0.89</td>
<td>0.005</td>
</tr>
<tr>
<td>Comorbid conditions</td>
<td>0.51</td>
<td>0.34, 0.74</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Live with someone; Y vs. N</td>
<td>0.49</td>
<td>0.26, 0.92</td>
<td>0.029</td>
</tr>
<tr>
<td>HMO Insurance; Y vs. N</td>
<td>0.45</td>
<td>0.23, 0.86</td>
<td>0.018</td>
</tr>
<tr>
<td>CMS Payment; Y vs. N</td>
<td>0.59</td>
<td>0.35, 0.98</td>
<td>0.043</td>
</tr>
<tr>
<td>Smoker; Recent-current vs. never-former</td>
<td>0.46</td>
<td>0.25, 0.84</td>
<td>0.014</td>
</tr>
<tr>
<td>Health perception: Very good vs. good, fair &amp; poor</td>
<td>8.57</td>
<td>4.09, 19.18</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*, Wald test
Predictors of Exercise Adherence

N= 492

Physical Activity & Exercise Behaviors
- Attitudes/Opinions
- Value of activity / exercise
- Past exercise history

Patient characteristics / Exercise factors

Comorbid Conditions
- Self rated health
- General social support
- Insomnia
- BMI

HF status/condition characteristics
- NYHA-FC
- Functional status
- On Evidence-Based HF Meds
- Cardiac device
- HF Etiology

Psychological, social, environmental, economic, and others
- Depression
- Equipment
- Distance/travel
- Enjoyment
- Family or social interest or support
- Guilt
- Making Time
- Motivation
- Others expectations
- Stress / Tired
- Self-confidence

Other factors
- Assistance
- Comfort
- Cost
- Functional Capacity
- Psychological, social, environmental, economic, and others

Albert NM ©, 2015 Exercise Adherence
Activity-Exercise Discoveries

Translation and translation needs:
• Include better messaging to patients about:
  – Benefits; esp. when health is poor!
  – What to do
  – *HOW to do it*
    – Reinforce / repeat education
    – Increase self-confidence
• Educate RNs about discussing mobility and activity with patients
• Need: RCT of *natural walking* and other physical activities in the hospital & immediate post-discharge period and clinical outcomes
Next Steps

• Need to learn more about why healthcare team members no longer routinely mobilize and ambulate patients

• Need to develop an in-hospital intervention to increase mobility and ambulation among patients with HF
Impedance Monitoring in HF

• *Congestion* is our #1 problem related to hospitalization

• *Objective markers* (*JVP, S3 heart sounds*) have poor sensitivity, but good specificity

• *Subjective markers* are not well understood by patients
  – Cannot tell when symptoms get worse
PCWP & Mortality Post Vasodilator Tx

![Graph showing the relationship between PCWP and mortality risk over time. The graph compares the total mortality risk (%) over months between PCWP >16 mm Hg and PCWP ≤16 mm Hg. The P-value is 0.001.]

Fonarow G. Reviews CV Med. 2001;257
CI & Mortality HF Post Vasodilator Tx

Cardiac Index >2.6 L/min-M²
Cardiac Index ≤2.6 L/min-M²

Fonorow GC. Reviews CV Med 2001;257
Hypothesis: If CO/CI measurements by Thoracic Impedance were Accurate, would “Impedance” also be accurate?

Mean discrepancy (bias) between thermodilution & bioimpedance cardiac output was very small: 0.08 L/min (range, -0.18 to 0.35)

Concordance correlation coefficient of all 29 paired measurements was 0.89 ($P < .001$)
Hypothesis: If CO/CI Measurements by Thoracic Impedance were Accurate, would “Impedance” also be Accurate?

• Thoracic fluid content values and LV diastolic pressures were converted into quartiles
  – Hypovolemia
  – Normal volume
  – Moderate hypervolemia
  – Severe hypervolemia
• Correlation: $r=0.39; p=.02$
  – Statistically significant
  – Clinically, not strong enough to act
<table>
<thead>
<tr>
<th></th>
<th>Whole body Bio-impedance</th>
<th>Thoracic Bio-impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Connection</strong></td>
<td><img src="image1.png" alt="Whole Body Connection" /></td>
<td><img src="image2.png" alt="Thoracic Connection" /></td>
</tr>
<tr>
<td><strong>Company/ Devices</strong></td>
<td>NI Medical – NICaS</td>
<td>Cheetah Medical, Osypka, Physioflow</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Meet FDA guidelines for statistical bioequivalence</td>
<td>Does not meet FDA guidelines for statistical bioequivalence</td>
</tr>
<tr>
<td><strong>Reproducibility</strong></td>
<td>Very good Strong and clean signal detected from the periphery</td>
<td>Compromised due to competing signals in the thorax area from aorta, lungs, atria, vena cava and artifacts due to heart movements</td>
</tr>
<tr>
<td><strong>Disposables cost</strong></td>
<td>Low (require only 2 sensors)</td>
<td>High (require 4 sensors)</td>
</tr>
<tr>
<td><strong>General</strong></td>
<td>5 min by technician No need to undress</td>
<td>15 min by technician Need to take off shirt</td>
</tr>
</tbody>
</table>
Whole Body Impedance

• PAWP and whole body impedance
  – N = 57 patients
  – Bland-Altman mean (SD) difference:
    – Total body water:
      – -29.7 (12.2)%; \( p < .0001 \)

• Summary:
  – There is no agreement between PAWP measurements of total body water
Informal Caregivers

• Play critical “roles” in effective management of HF
  – Contribute to self care
  – Provide social and emotional support
• But… what does that really mean?
Current “Supporter” Research

*Design:* Longitudinal comparative, 2 cohorts

- Patients & supporters; baseline and 90 day follow-up; *multiple research themes:*

  - **Patients:** (1) relationships w partners, (2) actual roles carried out in general and related to HF self-care, (3) thoughts and feelings about roles in HF, (4) health perceptions of self, and (5) characteristics

  - **Care partners:** 1 - 5 + perceptions of the patients’ functional status and services received, support from health care providers, burden, quality of life
Current Intervention Research

• IT person pitched a great idea about a potential way to decrease 30-day rehospitalization

• Involved developing a model and getting buy-in from a corporate partner
  – Found corporate partner who created a prototype and had 1000 samples made

• RCT in progress; need 1000 patients to observe meaningful differences in 30 day rehospitalization
  – Will complete an interim analysis after 500 enrolled to assess statistical trends
Thoughts About the Journey

- Collaborate with colleagues
- Develop partnerships
- Be willing to take a rocky or slippery road
- Make lemonade from lemons
- Use clinical practice and current/new knowledge to develop research ideas
  - Get input from others
My Research Journey

Collaboration ⇔ Make Friends …
Engaging Experiences ⇔
*Improve lives of patients*
FUN