Relative Energy Deficiency in Sport (RED-S):

A clinical approach for team physicians
Margo Mountjoy, MD, PhD
Associate Clinical Professor McMaster University
IOC working group on RED-S
Fédération internationale de natation
### Symposium Overview

<table>
<thead>
<tr>
<th>Topic</th>
<th>Speaker</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED-S: 2 cases</td>
<td>ALL (5 min +10 min discussion)</td>
<td></td>
</tr>
<tr>
<td>What is RED-S?</td>
<td>Margo Mountjoy (15 min)</td>
<td></td>
</tr>
<tr>
<td>Diagnosing RED-S</td>
<td>Naama Constantini (15 min)</td>
<td></td>
</tr>
<tr>
<td>Treating RED-S</td>
<td>Kathryn Ackerman (15 min)</td>
<td></td>
</tr>
<tr>
<td>Preventing RED-S</td>
<td>Jane Moran (15 min)</td>
<td></td>
</tr>
<tr>
<td>Panel Discussion</td>
<td>ALL (15 min)</td>
<td></td>
</tr>
</tbody>
</table>
What is RED-S?

The IOC consensus statement: beyond the Female Athlete Triad—Relative Energy Deficiency in Sport (RED-S)

Margo Mountjoy,¹ Jorunn Sundgot-Borgen,² Louise Burke,³ Susan Carter,⁴ Naama Constantini,⁵ Constance Lebrun,⁶ Nanna Meyer,⁷ Roberta Sherman,⁸ Kathrin Steffen,²,⁹ Richard Budgett,⁹ Arne Ljungqvist³

IOC consensus statement on relative energy deficiency in sport (RED-S): 2018 update

Margo Mountjoy,¹ Jorunn Kaiander Sundgot-Borgen,² Louise M Burke,³,⁴ Kathryn E Ackerman,⁵,⁶ Cheri Blauwet,⁷ Naama Constantini,⁸ Constance Lebrun,⁹ Bronwen Lundy,³ Anna Katarina Melin,¹⁰ Nanna L Meyer,¹¹ Roberta T Sherman,¹² Adam S Tenforde,¹³ Monica Klungland Torstveit,¹⁴ Richard Budgett¹⁵
Evolution of the Science: Female Athlete Triad

1986: Barbara Drinkwater

Eating disorder
  – Amenorrhea
  – Osteoporosis
Evolution of the Science: Female Athlete Triad

2007: ACSM (Nattiv et al.)
Low energy availability:
- continuum
- interrelationship
Evolution of the Science: Female Athlete Triad

Underpinning etiological factor: **Energy deficiency**

relative to the balance between the **energy intake**

and the **energy expenditure** of:

homeostasis

physical activity of daily living

sport activity
Evolution of the Science: Female Athlete Triad

EA = (EI - energy cost of exercise) / fat-free mass (FFM)

- In healthy adults, a value of 45 kcal/kg FFM/day equates appropriate EA or energy balance
Evolution of the Science

LEA no longer affects only Females!

- The clinical entity of RED affects males athletes as well as females
Low Energy Availability in Males

Cyclists
Severely reduced EA of 8 kcal/ kg/ FFM/d
[Vogt et al. 2005]

Jockeys
Experience the outcomes from low EA
[Dolan et al. 2011]
Evolution of the Science

It is no longer only a Triad!

Rather a syndrome resulting from RED that affects many aspects of physiological + psychological function beyond menstrual cycle and bone health
Relative Energy Deficiency in Sport (RED-S)

“The syndrome of RED-S refers to impaired physiological functioning caused by relative energy deficiency, and includes but is not limited to metabolic rate, menstrual function, bone health, immunity, protein synthesis, and cardiovascular health.”
Prevalence of Health Consequences of RED-S

Endurance, aesthetic athletes

elite football players  [Braun 2017]

artistic swimmers  [Schaal 2017]

endurance athletes  [Melin 2015]

ultra-marathoners  [Folscher 2015]

para-athletes  [Blauwet 2017]

cyclists  [Viner 2015]
Health Consequences of RED-S
Health Consequences of RED-S

Menstrual Dysfunction

? Long term fertility issue

[Loucks et al. 2003]

Functional hypothalmic amenorrhea


Emotional impact
Endocrine

Reduction in glucose utilisation

Mobilisation of fat stores

Slowing of metabolic rate

Increased growth hormone resistance

Endocrine changes in males

Low leptin + insulin

[Koehler 2016]

Low levels of glucose, testosterone + LH

[Stoud 1997, Heikura 2017]

Interruption of the GnRH and LH pulsatility + lower gonadal hormonal levels

Reproductive dysfunction

Impaired reproductive function in male endurance athletes training with high volumes

[de Souza 1997; Cumming 1989; Hackney 1988, Tenforde 2016]
Health Consequences of RED-S

Bone

Hypo-estrogenemia – negative impact on bone health
[De Souza 2008]

Low EA – negative impact on bone independent of low estrogen

Risk of stress fracture

Bone effects in men
Bone

In the absence of DE and EDs, male endurance athletes, (cycling, runners, triathletes) had greater risk of low BMD than controls

[Hind et al. 2006; Platen et al. 2001, Viner 2015, Heikura 2017]
Health Consequences of RED-S

Cardiovascular

Endothelial dysfunction

Abnormal lipid metabolism

Health Consequences of RED-S

Psychological / Psychiatric

Depression

DE+ED
[Stice et al. 2012, Darcy 2013]

Performance Consequences of RED-S

- Decreased glycogen stores
- Decreased muscle strength
- Decreased endurance performance
- Increased injury risk
- Decreased training response
- Impaired judgement
- Decreased coordination
- Decreased concentration
- Depression
- Irritability
Performance Consequences of RED-S

Reduced responsiveness to training and subsequent sport performance

[Van Heest 2014]
Performance Consequences of RED-S

Elite AUS rowers

4 week heavy training:
- lower RMR
- body comp changes
- increased fatigue
- lower LEA

Pre + post 5k time trial

[Woods 2017]
Performance Consequences of RED-S

27 F + 21 M elite endurance athletes at Flagstaff Arizona (altitude) prior to 2016 Rio

- Hgb mass lower in amenorrheic vs eumenorrheic athletes
- Increases in Hgb mass at altitude blunted in athletes with LEA
- **Negative** correlation between LEAF-Q score and % change Hgb mass
  ***p=0.07** (not statistically significant)

[Heikura 2018]
Performance Consequences of RED-S

Viral illnesses

[Hagmar 2008]

Low LEAF-Q + Depression + Stress = increase risk of illness (F)

[Drew et al 2017]
Performance Consequences of RED-S

Increased risk of injuries with LEA

[Thein-Nissenbaum 2011 + 2012; Heikura 2017]
Symposium Overview

**RED-S:** 2 cases

**What is RED-S?**
Margo Mountjoy (15 min)

**Diagnosing RED-S**
Naama Constantini (15 min)

ALL (5 min +10 min discussion)
Diagnosing RED-S

Naama Constantini, MD, FACSM
Director - Sport Medicine, Shaare Zedek Medical Center, Hebrew University, Jerusalem, ISRAEL
Chair- National Council on Women’s Health
Team Physician - Israeli Swimming
Vice Chair - LEN Medical Committee
IOC working group on RED-S
Diagnosing RED-S

History: Medical
       Sport & training
       Eating Habits & Attitude

Physical Examination:

Specific Tests:
       Blood & Urine test
       ECG
       RMR
       DXA
       Others
## Diagnosing RED-S

<table>
<thead>
<tr>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medical:</strong></td>
</tr>
<tr>
<td>General: Weakness, fatigue, sleep disturbances, infections (URTI), anemia, GI complains, hair loss, cold intolerance…</td>
</tr>
<tr>
<td>Growth &amp; development (if adolescent)</td>
</tr>
<tr>
<td>Menstrual Hx: Age of Menarche, oligo/amenorrhea)</td>
</tr>
<tr>
<td>Males: Impaired libido</td>
</tr>
<tr>
<td>MSK injuries: Stress Fractures, present &amp; past.</td>
</tr>
<tr>
<td>Mental: Depression, moody, nervousness….</td>
</tr>
<tr>
<td><strong>Medications:</strong> OCP</td>
</tr>
<tr>
<td><strong>Family Hx:</strong> Delayed menarche, osteoporosis, endocrine…</td>
</tr>
</tbody>
</table>
Diagnosing RED-S

History

Sport/training:

- Type of sport (aesthetic sports, weight category, endurance)
- No. of training h/w (increase)
- Level / achievements *
- Performance status (↓)
Nutritional/Eating Behaviour & Attitude:

• Eating habits (amount, type, frequency…)
• Weighing habits, Weight changes, Weight goals
• **DSM 5**: AN, BN, Binge eating disorder, Avoidant/Restrictive Food Intake Disorder (ARFED), Other Specified (or Unspecified) Feeding or ED + use of pathological means of losing weight

(*use of questionnaires such as EAT 26, EDI...*)

Unintentional / unawareness!!
Energy Availability Assessment

The amount of energy available to the body once the energy cost of exercise has been deducted from energy intake, relative to the athlete’s fat-free mass (FFM)

\[
\text{Dietary Energy Intake (Kcal) - Exercise Energy Expenditure (Kcal)} \div \text{LBM (Kg)} = \text{Kcal/Kg}
\]
### Energy Availability

<table>
<thead>
<tr>
<th>Energy availability</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 45 kcal/kg FFM</td>
<td>High energy availability for growth or gain of body mass</td>
</tr>
<tr>
<td>~ 45 kcal per kg FFM</td>
<td>Healthy energy availability for energy balance/weight maintenance</td>
</tr>
<tr>
<td>30-45 kcal per kg FFM</td>
<td>Reduced energy availability but still adequate for healthy weight loss (or weight maintenance at reduced metabolic rate)</td>
</tr>
<tr>
<td>&lt; 30 kcal per kg FFM</td>
<td>Low energy availability – health implications</td>
</tr>
</tbody>
</table>

Diagnosing RED-S

Energy Availability Is:

Energy intake (food) = 1500 Kcal
Energy exercise expenditure = 900 Kcal
Weight = 50 Kg, body fat 20%
   FM = 10 Kg, FFM = 40

EA = 1500-900 = 600

/ 40 = 15 Kcal/Kg
Diagnosing RED-S

Energy Availability Is:

- >45 kcal/kg FFM/d: Optimal Energy Availability
- 30 kcal/kg FFM/d: Minimum Required for Health
- 20 kcal/kg FFM/d: Borderline Energy Deficient
- 10 kcal/kg FFM/d: Moderately Energy Deficient
- <10 kcal/kg FFM/d: Severely Energy Deficient
Limitations in EA Assessment

- EI assessment (fluctuations, under-report*, inaccurate)
- EE assessment (training + NEAT, errors even with gadgets)
- % Body fat/FFM measurement (Lab & field methods, cost, accuracy..)
- Time consuming
- Duration of measurement (variability of EI & EE)

Physical Examination

- Height, Weight: Low BMI
- Low body fat
- Signs of ED:
  - AN: Dry skin, thinning of the hair, lanugo hair, yellow palms and feet
  - BN: Parotid gland enlargement, dental caries, callus on hands, red eyes…
- Heart Rate - Bradycardia
- Low BP (+ Orthostatic hypotension)
Diagnosing RED-S

Blood Tests

- CBC
- Iron status
- B12
- Folic Acid
- Vitamin D
- Biochemistry
- Glucose
- Lipid profile (cholesterol level)
- Serum Amylase
- Carotene
Diagnosing RED-S

Blood Tests II

Endocrinology:

Reproductive/Sex hormones
  • LH, FSH, Estradiol, Testosterone, PCOS screen prn…

Prolactin

Thyroid function tests
  • TSH, T4, T3

Cortisol

IGF-1, GH

(Leptin, Ghrelin…)

Diagnosing RED-S

Low Energy Availability

Physiological & Neuroendocrine Response

Cortisol, GH, RT3

Glucose, FFA, T3, Insulin, IGF-1, Leptin

Hypothalamus

GnRH pulses

Pituitary Gland

FSH, LH pulses

Ovaries

Progesterone, Estrogen

Amenorrhea
Diagnosing RED-S

Blood Tests in Males Suffering from LEA

Low LH & FSH, Low Free & Total Testosterone levels

(Sperm abnormalities)


Diagnosing RED-S

Dose-Response Relationship Between EA & Bone Turnover in Young Women

![Graph showing the dose-response relationship between energy availability and bone turnover in young women. The graph compares bone resorption and formation under conditions of amenorrhea and menstruating. Different markers represent the effects of hormones such as NTX, E2, PIC, P, and IGF-I.](graph.png)
Diagnosing RED-S

Urine Test

Ketones
Specific Gravity
Other Tests - ECG

- Extreme sinus bradycardia
- Low voltage
- Prolonged QT
- Arrhythmia
Diagnosing RED-S

Other Tests - RMR
Diagnosing RED-S

Other Tests - RMR

21 y.o. M runner

865 Kcal - 61% predicted

16 y.o. F volleyball player

589 Kcal - 39.2% predicted
Diagnosing RED-S

Other Tests- DXA for BMD
### Other Tests - DXA for BMD

<table>
<thead>
<tr>
<th>Z score</th>
<th>T score</th>
<th>BMD Bone mineral density</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td>0.854</td>
</tr>
<tr>
<td>-0.6</td>
<td>-0.6</td>
<td>0.935</td>
</tr>
</tbody>
</table>

Total Left Hip:
- (L Femoral neck) 0.854
- (R Femoral neck) 0.935

Total Right Hip:
- Lumbar spine 0.798

21 y.o. M runner
Diagnosing RED-S

Differential Diagnosis - Health Issues

According to the symptoms/signs!

- Amenorrhea*
- Delayed puberty
- Stress fractures
- Mental issues
- GI complains

Constantini & Warren, Menstrual dysfunction in swimmers, JCEM 1995
Rickenland, Fert. & Ster. 2003
Diagnosing RED-S

Differential Diagnosis- Performance Issues

Decreased performance
- Over-reaching/over-training
- Training errors
- Viral infection (EBV, CMV…)
- Sleeping issues
- Inadequate food (Carbs, Pro.)
- Vitamin/Mineral deficiencies
Diagnosing RED-S

Summary

In Females: Amenorrhea, Recurrent SF
In Males: High Index of Suspicion
In both: Performance

Check Nutrition!!
Diagnosing RED-S

THANK YOU!

naamacons@gmail.com
## Symposium Overview

<table>
<thead>
<tr>
<th>RED-S: 2 cases</th>
<th>ALL (5 min +10 min discussion)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is RED-S?</strong></td>
<td>Margo Mountjoy (15 min)</td>
</tr>
<tr>
<td><strong>Diagnosing RED-S</strong></td>
<td>Naama Constantini (15 min)</td>
</tr>
<tr>
<td><strong>Treating RED-S</strong></td>
<td>Kathryn Ackerman (15 min)</td>
</tr>
</tbody>
</table>
Treating RED-S

Kathryn Ackerman, MD, MPH, FACSM
Assistant Professor- Harvard Medical School
Endocrinology and Sports Medicine
Director- Female Athlete Program- Boston Children’s Hospital
Team Physician- USA Rowing
IOC working group on RED-S
GOALS:

• Achieve optimal energy availability for health and performance

• Allow training/sport participation at a safe and appropriate level
# Treatment of RED-S

**RED-S CAT™**
Relative Energy Deficiency in Sport (RED-S) Clinical Assessment Tool (CAT)

<table>
<thead>
<tr>
<th>STEPS</th>
<th>RISK MODIFIERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Evaluation of health status</td>
<td>Medical factors</td>
</tr>
<tr>
<td>2. Evaluation of participation risk</td>
<td>Sport risk modifiers</td>
</tr>
<tr>
<td>3. Decision modification</td>
<td>Decision modifiers</td>
</tr>
</tbody>
</table>

### Treatment of RED-S

#### Training Recommendations

<table>
<thead>
<tr>
<th>HIGH RISK RED LIGHT</th>
<th>MODERATE RISK YELLOW LIGHT</th>
<th>LOW RISK GREEN LIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- No competition</td>
<td>- May train as long as he/she is following the treatment plan</td>
<td></td>
</tr>
<tr>
<td>- No training</td>
<td>- May compete once medically cleared under supervision</td>
<td></td>
</tr>
<tr>
<td>- Use of written contract</td>
<td></td>
<td>- Full sport participation</td>
</tr>
</tbody>
</table>

Treatment of RED-S

- Anorexia nervosa or other serious ED
- Other serious medical conditions (psychological and physiological) related to low EA
- Extreme weight loss techniques leading to dehydration-induced hemodynamic instability
- Severe ECG abnormalities

Treatment of RED-S

- Prolonged abnormally low % body fat
- Substantial weight loss (5-10% body mass in 1 month)
- Attenuated growth and development (adolescent)
- Low EA of prolonged &/or severe nature
- Abnormal menses/hormonal profiles
- BMD Z-score <-1 or a decrease compared to prior DXA
- Hx of ≥1 stress fx a/w hormonal dysfunction &/or low EA
- Complications a/w low EA (ECG findings, lab results)
- DE negatively affecting teammates
- Lack of progress/compliance

Treatment of RED-S

- Appropriate physique that is managed without undue stress or unhealthy diet / exercise strategies
- Healthy eating habits with appropriate EA
- Normal hormonal and metabolic function
- Normal BMD as expected for sport, age, sex, and ethnicity
- Healthy musculoskeletal system

Need to get Buy-in from the Athlete

- Review symptoms, performance decrements, injuries, goals
  - How many stress fractures have you had?
  - How often do you get sick?
  - How much training have you missed from these injuries/illnesses?
  - Continued amenorrhea will slow recovery and lead to worsening bone density and strength
  - How have your race times been? Are you continuing to improve in performance with all of your training?
  - Libido, mood, etc.
Treatment of RED-S

Interdisciplinary Team

• Physician:
  • Risk assessment
  • Medical management
  • Typically final call on RTP (w/ shared decision-making)

• Dietitian:
  • Energy availability
  • Micro/macronutrient improvement
  • Timing of food
  • Address ED/DE behaviors

• Psychotherapist/Psychologist:
  • Address underlying issues
  • Target anxieties
  • Athlete identity
Interdisciplinary Team

- **Coach/Physio/Trainer:**
  - Redirecting training
  - Addressing strength, flexibility, biomechanical issues

- **Family/Friends:**
  - Emotional support
Treatment

of

RED-S

RED-S CAT
Treatment Contract

Treating RED-S

Assessing and Monitoring Low EA

- No standardized protocol for undertaking an EA assessment
- Concerns over validity and reliability
- Ideal to measure exercise expenditure during multiple days of training/competition
- LEA states can develop at varying times of training

Assessing and Monitoring Low EA

• Direct calorimetry
• Indirect calorimetry
• Predictive Equations
  • Harris-Benedict, Mifflin St. Jeor, etc.
• Bio Impedance Analysis
• Dual Energy X-ray Absorptiometry (DXA)
• Sport specific guidelines

Treating RED-S

Provide Data (as appropriate)

- Labs
- Body Composition
- Performance measures
- Changes over time
Treating RED-S

Male Runner: Laboratory Results

- WBC: 3020 cells/μL (L)
  - 13.0
  - 39.3
  - 217
- MCV: 101.4 (H), RDW: 12% (L), Retic: 1% (nL)
- ANC: 1380 cells/μL (L)
- Ferritin: 15 ng/mL (L)
- Iron: 38 mcg/dL (L)
- TIBC: 342 mcg/dL
- ESR: (wnl)  CRP: (wnl)
- 25 (OH) Vit D: 20 ng/mL (L)
- B12: 227 pg/mL (L)
- Folate: (wnl)
- TSH: 2.14 mIU/L
- Free T4: 1.1 ng/dL
- T3: 2.2 pg/mL (L)
- LH: 4.38 IU/L  FSH: 4.05 IU/L (L/μL)
- Free testosterone: 44 pg/mL (L)
- Total testosterone: 32 ng/dL (L)
- SHBG: 44 nmol/L
- IGF1: (wnl)
- Prolactin: (wnl)
- TTG IGA and Total IgA: (wnl)

- AST: 23 u/L  ALT: 7 u/L
- Ca: 9.9 Mg: 2.2 Ph: 3.7
Male Runner Dual Energy Absorptiometry (DXA) Results

Lumbar spine Z-score: -2.3
Fem neck Z-score: -0.6
Total hip Z-score: -0.2
Female Body Composition DXA Results

Treating RED-S
## Treatment of RED-S

### Rate of EA correction

- Depends on athlete motivation and metabolic adjustments

- Restoration of menses (months to years)

- Restoration of BMD (may never normalize, but can improve over time)

---

Bone Mineral Density

- Optimize Calcium and Vitamin D
  - Calcium 1300 mg/d in adolescents & 1000 mg/d in adults
  - Vit D level ≥ 30 ng/ml (75 nmol/l)
- Avoid OCP
  - inconclusive evidence re: BMD
  - masks amenorrhea
- Consider Transdermal Estrogen with Cyclic Oral Progesterone
- Consider recombinant PTH 1-34 for delayed healing fx and severely low BMD (with bone expert consult)
  - Improved BMD in subjects with AN
  - Not studied in athletes
  - Contra-indicated in youth

Menstrual Function

If no resumption of menses within 6 mo of improved dietary intake, consider:

- Noncompliance (DE/ED/overtraining)
- Metabolic adjustment
- Transdermal estradiol with cyclic oral progesterone
  *(not a form of birth control)*

Treatment of RED-S

Eating Disorders

- Determine level of care and monitor
  - Outpatient, Intensive outpatient (IOP), Residential, Hospitalization
- Interdisciplinary team with expertise in EDs
- Remember co-morbidities
  - depression
  - anxiety
  - substance abuse

## Training Recommendations

<table>
<thead>
<tr>
<th>HIGH RISK RED LIGHT</th>
<th>MODERATE RISK YELLOW LIGHT</th>
<th>LOW RISK GREEN LIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>- No competition</td>
<td>- May train as long as he/she is following the treatment plan</td>
<td>- Full sport participation</td>
</tr>
<tr>
<td>- No training</td>
<td>- May compete once medically cleared under supervision</td>
<td></td>
</tr>
<tr>
<td>- Use of written contract</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Treatment of RED-S

THANK YOU!

@DrKateAckerman
<table>
<thead>
<tr>
<th>RED-S: 2 cases</th>
<th>ALL (5 min +10 min discussion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is RED-S?</td>
<td>Margo Mountjoy (15 min)</td>
</tr>
<tr>
<td>Diagnosing RED-S</td>
<td>Naama Constantini (15 min)</td>
</tr>
<tr>
<td>Treating RED-S</td>
<td>Kathryn Ackerman (15 min)</td>
</tr>
<tr>
<td>Preventing RED-S</td>
<td>Jane Moran (15 min)</td>
</tr>
</tbody>
</table>
Preventing RED-S

Jane Moran, BSc PT, MD, FRCP(C), Dip Sport Med
Assistant Clinical Professor- UBC Faculty of Medicine
Chair- International Skating Union Medical Commission IOC
Medical Commission Games Group
Preventing RED-S should be a priority for coaches, sports medicine professionals and all sport organizations.
Preventing RED-S

Education

COACH and MEDICAL PROFESSIONALS

Awareness of effects of
- External load
  - hrs of training, distance, frequency
- Internal training load
  - internal physiological and psychological response to external load

Preventing RED-S

Education

SPORT MEDICINE PROFESSIONALS

- PHE screening tools
- Interdisciplinary support
- Promote early recognition and treatment
- Incorporate educational programs in sport governing bodies nationally and internationally
- Promote rule changes in at risk sports
Preventing RED-S

Assessment

• High index of suspicion
• PHE: Utilize the RED-S Clinical Assessment Tool (RED-S CAT) for screening and managing RED-S
• Physiological screening
• Monitor symptoms for overtraining syndrome
• Enforce return to play guidelines for RED-S
Preventing RED-S

Assessment

- Low Energy Availability (LEA) plays a pivotal role in development of RED-S
- No standard guidelines to determine EA
- Screening (BEDA-Q, LEAF-Q, etc.) for eating disorders and LEA
- Menstrual history and Libido
- Assessment of Bone and Psychological health
Preventing RED-S

Minimize Risk

Rule Changes

• Addressed the problem of underweight in ski jumping
  “The lighter you are the farther you fly”

• Rule change in 2004

• Percentage of underweight ski jumper decreased from 22.8% to 8.7% from 2002 to 2004

Preventing RED-S

Minimize Risk

- Provide reliable and reputable sources of information
- Encourage and support early recognition and treatment
- Monitor and adjust load as necessary
- Encourage adequate recovery time when planning competitive schedule
Preventing RED-S

Research

- Design tools to accurately assess EA
- Evaluate current screening tools and treatment
- Incorporate injury/illness surveillance programs
Thank you for your attention