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CSANZ New Zealand Annual Scientific Meeting

TSB Arena & Shed 6, Wellington | 13-15 June 2019

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Cardiac Society of Australia and New Zealand

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OraKinetics Clinic

CLINICAL EXERCISE PHYSIOLOGY

Cardiac Rehabilitation in New Zealand – way forward with Clinical Exercise Physiology

Sharing data and perceptions based on seven years practical experience in a DHB funded clinic in Palmerston North

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Outline

- Nature of the service (e.g., what it is, how we operate, why we operate in a certain way, why there is a need for the service);
- Referral pathways (e.g., type of work that needs to be done to create robust, safe and effective referral pathways);
- The response of the medical community on the service (e.g., number of referrals, number of GP's sending patients, size of our waiting list, types of patients we receive)
- Patient response to the service
- Physiological/medical impact of the service
- The estimated financial impact of the service over the first 5-years
- Future needs (e.g., work that needs to be done to establish the service nationwide).

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What is an ACEP?

Exercise Prescription specialists with an Advanced Applied Exercise Physiology Qualification (Level 8) that prepares them to work with medically 'at-risk' individuals

Clinical Requirements

Minimum of 540 Hours Clinical Exercise Physiology Experience:

- 180 hours – Cardiovascular or Metabolic (incl. Diabetes) conditions
- 120 hours – Respiratory, Neurological conditions or Cancer
- 180 hours – Orthopaedic/Musculoskeletal injuries or conditions
- 60 hours either additional to above or other clinical exercise activities

Practice Requirements

Pass an entry exam to register as an Accredited CEP with CEPNZ and CPRB

Maintain ongoing professional development to maintain Accreditation status

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U-Kinetics *Te Huinga Waiora*





U-KINETICS TE HUINGA WAIORA

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Initial Challenges

At start-up

First year

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Challenges and lessons over first 5-years

At start-up	On-going refinements

• How service will differ from physiotherapy and PT
• Entry and exit criteria
• Creating a referral process and pathways
	• Establishing communication channels
	• Referring process
	  • GPs and Clinics = extensive waiting list
	• Re-referrals
	• Aligning with other existing services
	  • GRx
	  • PHO

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Basic Method of Operation

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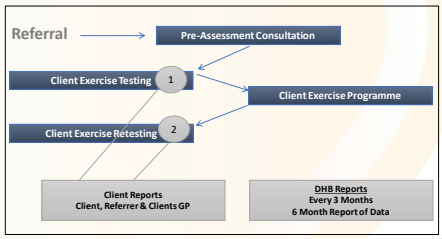
Patient Journey



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Symptom-limit Prescription based on Graded fitness test with ECG

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CEP's – tailored Supervised Exercise Prescription

Tailored and supervised exercise programmes for people with complex and chronic (long term) conditions

- A Tailor
  - Measures with a measuring tape at pre-determined landmarks (not with a scale)
  - Design clothes specific to the individuals measurements
- Without measurement (using the correct tools and protocols)
  - The design is not tailored
  - Can't create an exact fit
  - Outcome is unsatisfactory
- To challenge the musculoskeletal and cardiovascular systems you need to know the functional borders
  - Exact pressure requires precise measure
- Supervise means to observe and direct; to pilot execution
  - You are either a good pilot or a dead pilot
  - Good pilots follow protocols and read their instruments
  - The worse the conditions the more important the navigational instruments
- Complex and chronic means bad 'flying 'conditions
  - You need a plane designed for the conditions (training environment)
  - You need to carefully map out your flight plan (precise measure to create exact pressure – Stress ECG and other testing equipment)
  - Your safety is dependent having the correct navigational instruments and following the navigation protocols (Accredited CEP with good monitor tools)
  - Reaching your destination is dependent on the pilots ability to negotiate the flying conditions and operate the plane (experienced operator that know how to negotiate bad conditions)
  - Each of the above becomes incrementally more pivotal in the absence of the previous ones
  - If the first three is missing then number four (experienced operator with years of hands on experience) is non-negotiable

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Monitoring

Early Warning Signs (EWS)							
Rating	3	2	1	0	1	2	3
Respiratory Rate	< 8			9-14	15-19	20-30	>30
Pulse/min	< 40		40-50	51-100	101-110	111-130	>130
30 sec ECG				Normal	Some arrhythmia	< 6 PVC/min	>6 PVC/min
Systolic Blood Pressure (mmHg)	< 90	90-99	100-110	111-140	141-160	161-170	>170
Medication				Taken Meds			Forgot to take medication
Glucose Levels mmol.l^{-1}				< 5.55	>13.88 with no ketosis	>16.65 with no ketosis	>13.88 with ketosis
Complexion	Red, hot, confused			Fully alert	Slow to respond	Confused	Pale, cold and low alertness
Symptoms				No Angina or other symptoms		Light barely noticeable symptoms	Moderate bothersome angina or symptoms

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Typical Patients

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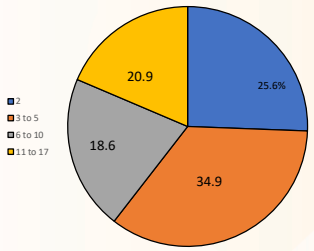
Clinical Characteristics - Cardiac Patients



Complexity criteria

Valve regurgitation
Diagnosed MI
Diagnosed HF
Reduced EF
Exertional Angina
Frequent GTN
Extreme Obesity (Walking not an option)
NIDDM
Abnormal resting ECG (e.g., multi foci PVC's or AF)
Abnormal Exercise ECG
Hypertension
Abnormal Ex SBP response
Abnormal Ex DBP response
CABG
Stent
High levels of psychological stress
Diagnosed depression
Other: Stroke; MS; COPD; Cancer

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Patient Results

Seven years (2012 – 2019)
U-Kinetics – 424 Cardiac Patients
OraKinetics – 113 Cardiac Patients

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Perceived benefits - Results

Variable	Pre-training		Post-training		P-value
	x	SD	x	SD	
Physical Function	39.3	11.3	44.0	10.4	0.0001
Role-Physical	39.2	11.1	45.0	10.5	0.0001
Body Pain	45.0	11.2	48.9	9.7	0.0001
General Health	40.5	11.0	45.2	11.1	0.0001
Vitality	45.4	10.1	50.7	11.1	0.0001
Social Function	43.9	11.7	48.9	10.4	0.0001
Role-Emotion	42.6	14.4	48.2	10.9	0.0001
Mental Health	49.1	10.5	52.7	9.6	0.0002
Physical Component	39.2	10.3	43.9	9.2	0.0001
Mental Component	47.9	11.4	52.8	10.1	0.0001
CES-D	12.9	10.2	9.5	7.9	0.0004
HADS Anxiety	5.9	3.8	4.5	3.1	0.0001
HADS Depression	4.8	3.3	3.2	2.8	0.001

SF-36v2 QUESTIONNAIRE

ALL QUESTIONNARES SHOWED SIGNIFICANT IMPROVEMENTS

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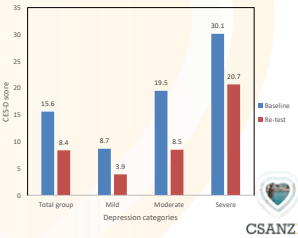
Depression - Results

Category	Baseline Mean (± STD)	Final assessment Mean (± STD)	Average % Change	ES
Overall CES-D Score	15.6 (±9.6)	8.4 (±8.1)	52%	0.89*
Mild depression	8.7 (±4.6)	3.9 (±3.2)	57%	1.0*
Moderate depression	19.5 (±1.7)	8.5 (±5.2)	57%	2.1*
Severe depression	30.1 (±6.3)	20.7 (±7.1)	31%	1.3*



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Physiological variables - results

Variable	Pre-training		Post-training		P-value
	MEAN	SD	MEAN	SD	
RSBP	136.0	16.5	131.6	14.6	0.0001
RDBP	80.8	9.9	78.1	9.4	0.0001
Body Weight	92.6	23.7	91.8	22.9	0.62
BMI	33.5	8.2	32.1	8.4	0.31
Percentage body fat	28.1	14.2	26.9	13.4	0.32
$Watt_3$	58.9	25.7	80.7	35.1	0.0001
$VO_{2\ peak}$	19.6	6.1	23.2	7.0	0.0001
MET	5.6	1.7	6.6	2.0	0.0001

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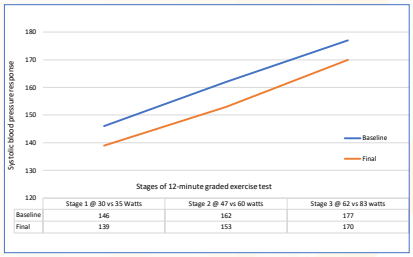
SBP response during graded exercise test



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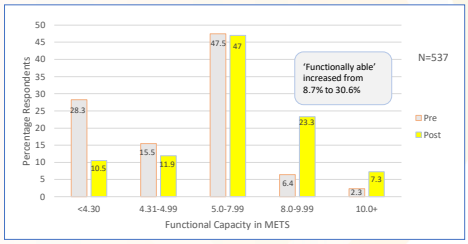
Programme effect on functional capacity (Vo_{2peak})



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Functional Capacity (Research)

- Research: Cardiovascular Disease (Van Hees *et al.*,1994)
  - 527 men with CVD, VO_2 directly measured, 6.1 year study
  - **Highest all-cause mortality = FC < 4.4 METs**
  - **No deaths in cohort with FC > 9.2 METs**
- Research: Cardiac Exercise Rehabilitation (Martin *et al.*, 2013):
  - Trained MI patients for 12-weeks
  - 5600 men; 1300 females
  - **Each 1 MET increase in FC = 22% reduction in mortality 1 year later**
- Research: Heart Failure Patient Study (Feuerstadt *et al.*, 2007)
  - 600 patients; Ejection fraction <35%
  - 12-weeks training
  - **Each 1 MET increase in FC = 28% reduction in mortality**

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Chest. 1993 Sep;104(3):701-4.

Preoperative evaluation of cardiac failure and ischemia in elderly patients by cardiopulmonary exercise testing.

Older P[1], Smith R, Courtney P, Hone R.

Table 1—*Mortality Data: AT Above and Below 11 ml/min/kg

AT, ml/min/kg	No.	CVS Deaths	Percentage Mortality
<11	55	10	18
≥11	132	1	0.8
Totals	187	11	(p<0.001)

*AT = anaerobic threshold; CVS = cardiovascular.

Table 2—*Mortality Data: AT Above and Below 11 ml/min/kg Associated With Preoperative Ischemia

AT, ml/min/kg	No.	No. With Ischemia	CVS Deaths	Percentage Mortality
<11	55	19	8	42
≥11	132	25	1	4
Totals	187	44	9	(p<0.01)

*AT = anaerobic threshold; CVS = cardiovascular.

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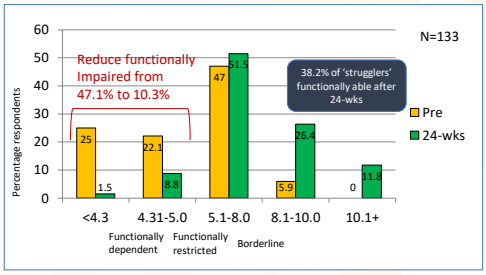
The 'strugglers' – 24-weeks



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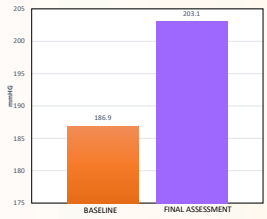
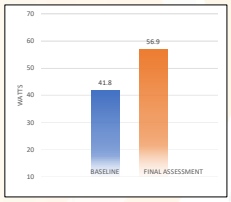
Training effect on Maximum exercise Wattage and RPP of fragile patients (Post-exercise < 4.3 METS)



RPP during graded cycle ergometer test



Wattage attained during graded cycle ergometer test

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Financial impact of U-Kinetics – ESSA study

- ESSA commissioned Deloitte Economics – value of accredited CEP in Australia
- Used AHS survey to assess effect of CEPs on DM2 and CVD service utilization:
  - number of GP consultations;
  - number of specialist consultations;
  - number of admissions to hospital as an inpatient;
  - number of visits to outpatient clinics;
  - number of visits to emergency/casualty department; and
  - number of visits to day clinics.
- DM - $ 7 967 annual saving
- CVD - $1903 annual saving
- U-Kinetics – 12-week completers over 5-years
  - 284 DM
  - 424 Cardiac patients
  - $3.1 million saving for local DHB
  - Conservative estimate; not included:
    - 303 respiratory clients
    - 40% of cohort completed 12-weeks in 2012 and 2013
      - No impact calculated for 2014, 2015 and 2016

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Way forward with Cardiac Rehabilitation in New Zealand

Why Clinical Exercise Physiology?

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One of the most clearly established findings of health education research is that health-related information is rarely sufficient to initiate or maintain health-related practices

Human behaviour is unlikely to change unless preceded by changes in attitudes, values, and self-concept

1. Know the facts
2. Apply the information
3. This creates understanding
4. Which impact on self-concept and values
5. Which change attitudes and behaviour

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Benatar *et al*. (2016). Cardiac Rehabilitation in New Zealand – moving forward. *New Zealand Medical Journal*, 129 (1435): 68-74

- No clear performance/credentialing indicators of providers
  - No standard when it comes to CR
- No cohesive/standardized delivery approach
- Less than 50% of programs assess exercise capacity
  - It is analogous to a physician providing treatment without a diagnosis
  - Community interventions on average 50% less effective than clinical trails
  - Reason – less precise prescription and less re-prescription (load adjustments)
- How do you standardize delivery and create quality control?
  - Create funding for a best practice accredited service deliver
  - Align and triage service delivery models

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Cardiac Rehabilitation – THE GAPS

- **Limited access – paucity of options/standardized funded clinics**
  - Educational sessions run by a nurse and a booklet is not effective CR
- **Inadequate rates of referrals**
- **No tailored prescription**
  - To attain adequate levels of fitness in groups most vulnerable
  - To provide a safe exercise environments
- **No alignment of service models to maintain long-term behavior**
  - Along with Associated Funding Issues

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It's not about energy expenditure anymore

- **It's about fitness**
- **It's about challenging the cardiovascular and musculoskeletal systems**

The question today is not whether physical activity per se has beneficial effects. The question is how to attain sufficient levels of high-intensity exercise in all strata of the population.

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Current Model in Palmerston North

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Current health-related physical activity programmes in the Manawatu

GRx	PHO	U-Kinetics OraKinetics
Main Features	Main Features	Main Features
• Limited pre-entry screening • No baseline and post-training data • Limited reports • Limited patient feedback and education • Group training- sessions • Two sessions per week • Receiving some patients not physically capable of benefiting from group classes	• Screening • Limited pre-entry testing/data • Some patient feedback • Group sessions and individual sessions • Offer programmes at commercial gyms • Limited monitoring (1 session per week)	• Comprehensive baseline and programme completion screening and assessment • Comprehensive data sampling to assess programme effect • Individualized programme prescription • Extensive monitoring • Individual and group sessions • 2 to 3 sessions per week

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Integrated Model for Cardiac Exercise Rehabilitation service delivery in the Manawatu

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Summary

- Need to let go of the idea that walking and an educational booklet is cardiac rehab
- Need clear/automatic referral pathways
- Triage of exercise services delivery (e.g., GRx, PHO and CEP)
  - Right patient to the right programme
- Best practice CR requires:
  - Tailor made facilities (e.g., standardized training, testing and monitor equipment and procedures);
  - Individualized prescription for the high risk/frail patients preferably by an ACEP
- Funding – better alignment of money across delivery models

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Slides that might be useful during QaA session

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What is a 'clinical exercise physiologist?'

A clinical exercise physiologist can be defined as an individual who specialises in the delivery of exercise, lifestyle and behavioural modification programmes for the prevention and management of chronic conditions and diseases, and musculoskeletal injuries

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Typical Patient Profile at Baseline

Cardiac:
- Low functional capacity
- Impaired ejection fraction
- Low/high resting BP
- Orthostatic intolerance
- Angina
- Peripheral arterial disease
- Overweight/fragile
- Poor response on exercise
  - Post-exercise dizziness
  - ECG changes
  - Poor BP response
  - Intermittent claudication

Respiratory:
- Low functional capacity
- Regular exacerbations
  - Chest inflammation
  - Hospitalization
- Borderline resting O_2 saturation levels
- Fragile
- Muscle atrophy/circulatory steal
- Exercise desaturation

Diabetic:
- Foot ulcers
- Overweight
- Poor glucose control
- Limited understanding of need to control glucose
- Poor dieting habits
- High insulin usage
- Multiple conditions
  - Heart disease
  - PAD
  - Elevated BP
  - Stroke
- Poor exercise response
  - Post exercise hypoglycemia
  - Rhythm changes
  - Silent angina
  - Intermittent claudication

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Client status at start of programme

Functional Capacity in METs				
<4.31	4.32-4.99	5.0-7.99	8.0-9.99	10+
28.3%	15.9%	48.5%	6.9%	0.5%

Dyspnoea and Angina During Cycling			
None	Mild	Moderate	Severe
37.0%	30.1%	17.6%	15.3%

Resting Blood Pressure (mmHg)				
	<110/70	112-140/72-90	160-180/90-100	180/102+
SBP	8.5%	63.4%	27.3%	0.8%
DBP	19.3%	67.6%	11.1%	2%

Peak Cycle Wattage				
<25 watt	25-35 watt	36-50 watt	51-100 watt	> 100 watt
6.8%	17.3%	24.9%	46.2%	4.8%

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Effect on Haemodynamic Variables

Category	Baseline Assessment Mean (± STDEV)	12 Week Assessment Mean (± STDEV)	Final Assessment Mean (± STDEV)	% Change Baseline to 12 Weeks	% Change Baseline to 24 Weeks	% of Total Change Achieved in First 12 Weeks
Systolic BP	136.6 (±16.7)	131.1 (±14.2)	126.4 (±12.2)	-4%	-8%	50%
Stroke Volume	56.2 (±16.5)	53.8 (±14.1)	52.0 (±12.9)	-4%	-7%	57%
mVO_2	87.2 (±18.1)	84.4 (±16.9)	78.5 (±15.0)	-3%	-10%	30%
MAP	99.1 (±10.5)	95.2 (±10.9)*	91.8 (±8.7)*	-4%	-7%	57%
SBP_{max}	205.7 (±49.5)	189.8 (±39.5)	187.4 (±32.2)	-8%	-9%	89%
$Watt_{max}$	80.2 (±21.8)	89.2 (±35.9)*	110.4 (±46.2)*	48%	83%	58%
RPE_{max}	19.9 (±8.47)	15.2 (±5.19)*	13.9 (±7.44)*	-18%	-22%	82%
mVO_2 s3	218.3 (±37.9)	223.4 (±34.9)	240.3(±49.9)	2%	10%	20%
VO_{2peak}	19.6 (±5.67)	24.7 (±7.23)*	28.2 (±6.88)*	26%	44%	59%
CRI	39.3 (±13.3)	36.2 (±10.3)	32.5 (±6.67)	-8%	-17%	85%

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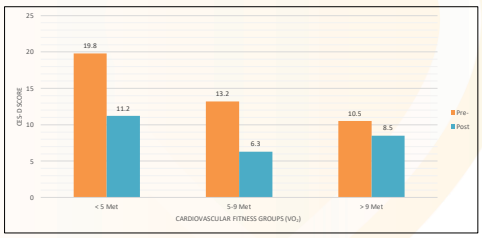
Effect on depression within cardiovascular fitness groups



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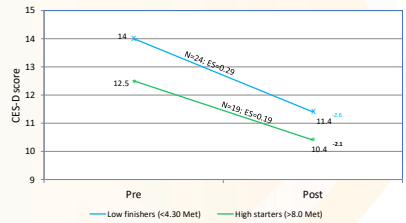
Low End vs high start capacity (MET) and CES-D after 12-weeks



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12-week training effect on some physiological variables in 24 low finishers (Post-exercise MET <4.3)

Variable	Baseline		Final		p-value	ES
	x	SD	x	SD		
RSBP	140.3	18.8	135.1	13.8	0.27	0.27
RDBP	80.8	12.6	76.4	11.1	0.21	0.35
Weight (kg)	105.8	34.3	104.8	33.1	0.91	0.03
$Watt_3$	32.7	7.1	40.3	9.3	0.003	0.81
RPE_{slope}	18.1	6.5	14.9	6.6	0.10	0.48
SBP_{slope}	203.0	65.1	186.8	70.4	0.41	0.23
Angina	3.2	1.5	2.6	1.7	0.23	0.35

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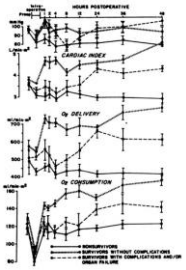
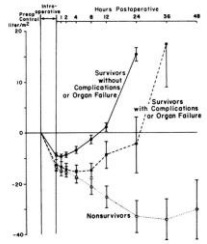
[Chest. 1992 Jul;102(1):208-15.]

Role of oxygen debt in the development of organ failure sepsis, and death in high-risk surgical patients.

Shoemaker WC[1], Appel PL, Kram HB.





Time to restore O_2 debt in survivors, survivors with complications & non-survivors

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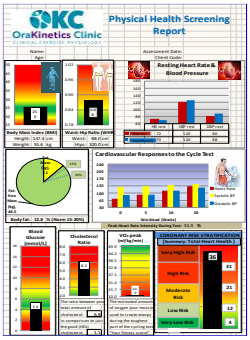

OraKinetics reports

- Patients
- Medical referrer
- GP

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