Musculoskeletal Health

Addressing the disconnects in musculoskeletal health through population and health service research

Asst Professor Bryan Tan Yijia MBBS, MRCS(Edin), MMed(Ortho), FRCS, PhD

Consultant, Orthopaedic Surgery, Woodlands Health, National Healthcare Group, Singapore

Deputy Director, Rehabilitation Research Institute of Singapore, NTU

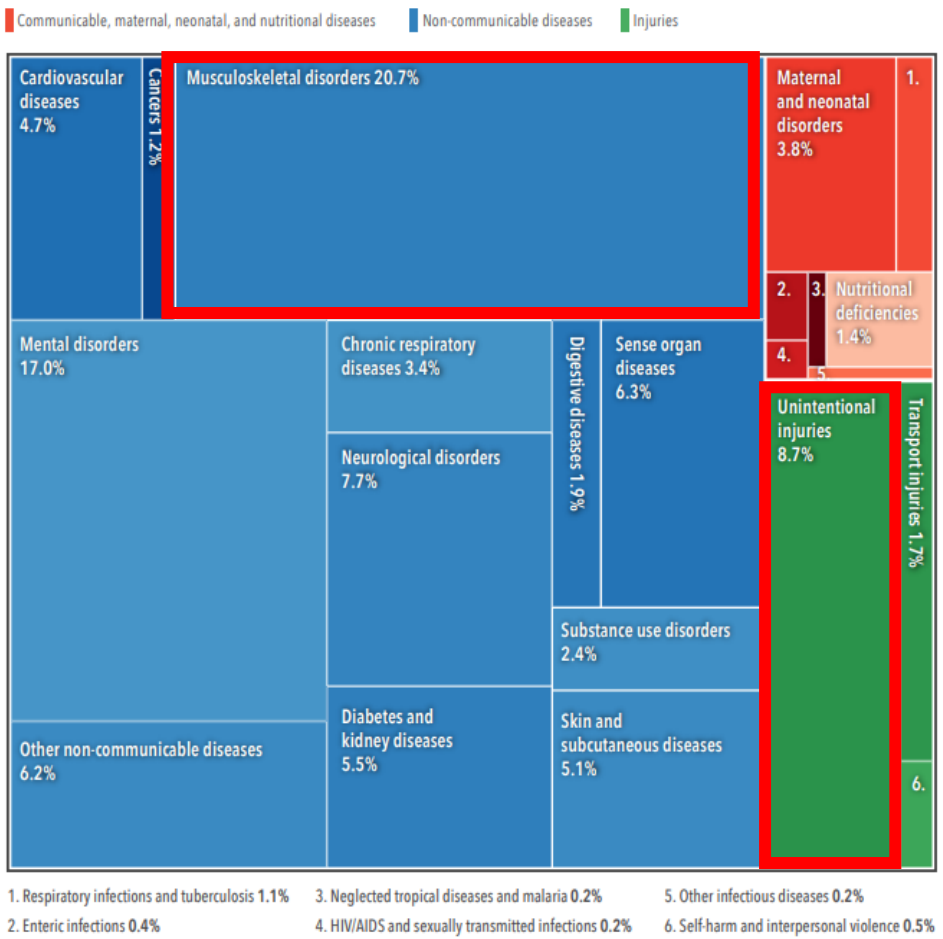
LEE KONG CHIAN SCHOOL OF MEDICINE
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
Imperial College London

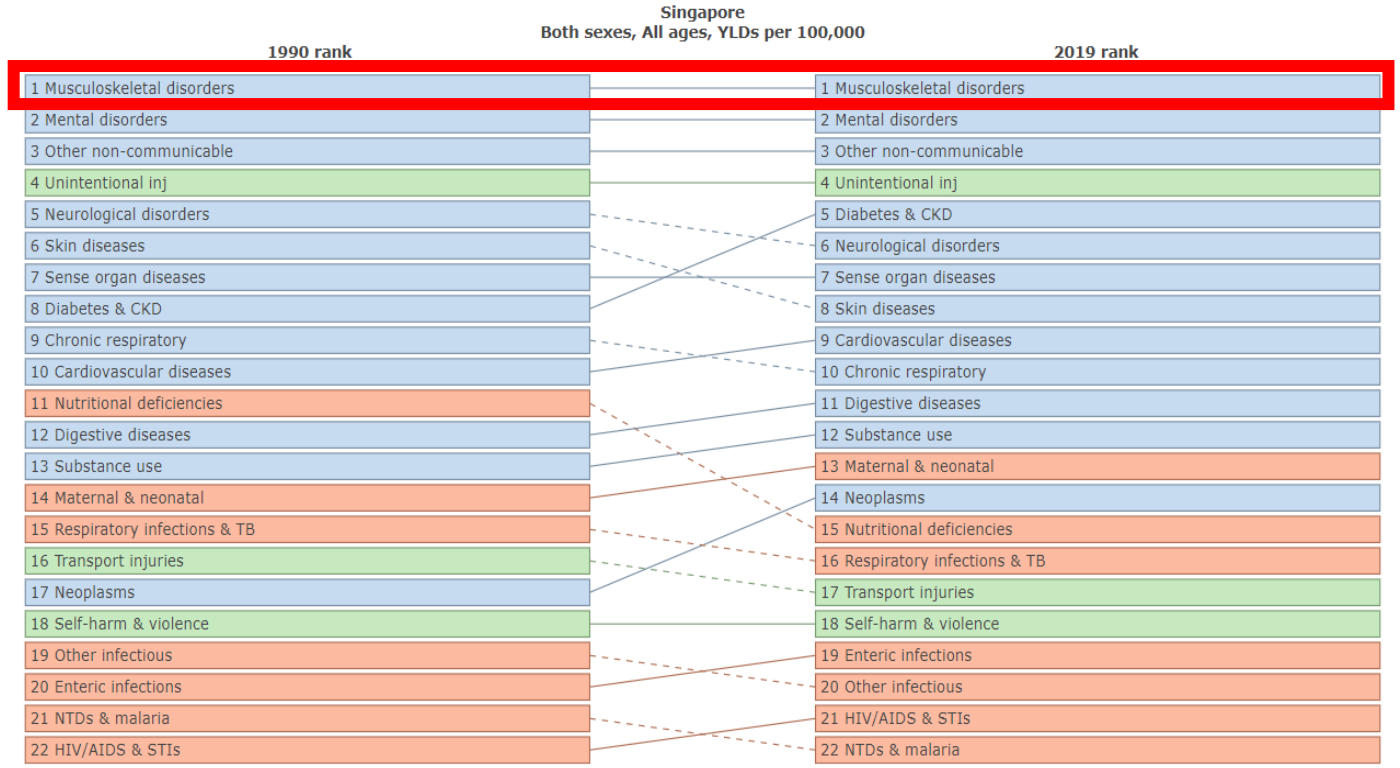
National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

Burden of Musculoskeletal diseases

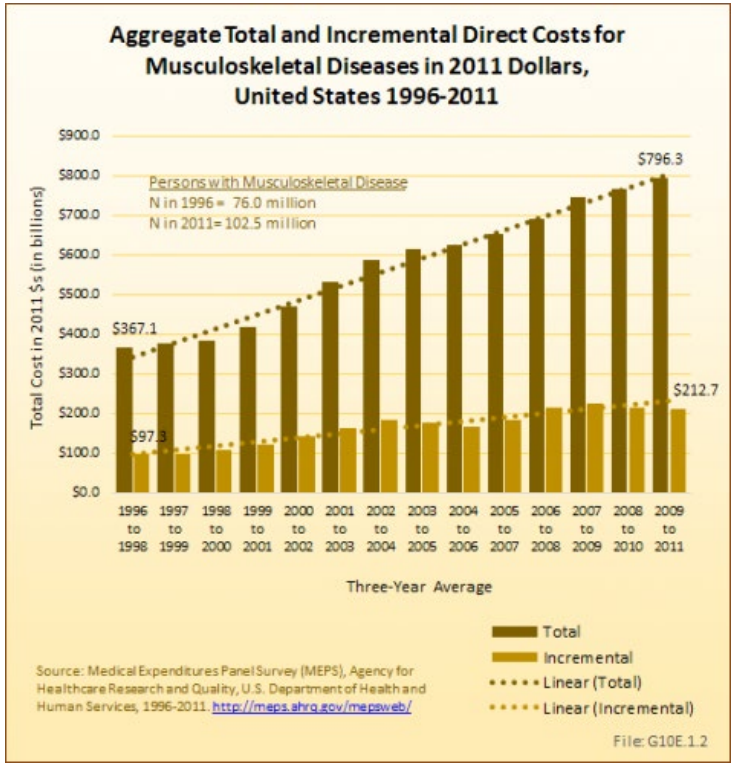
Distribution of total YLDs by cause, Singapore, both sexes, 2017

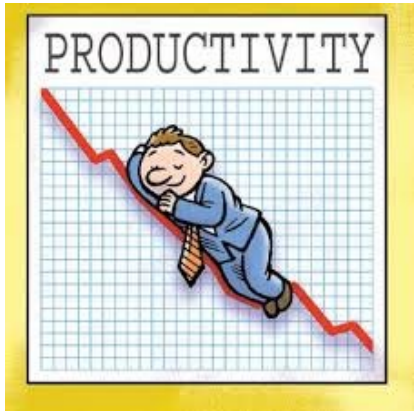


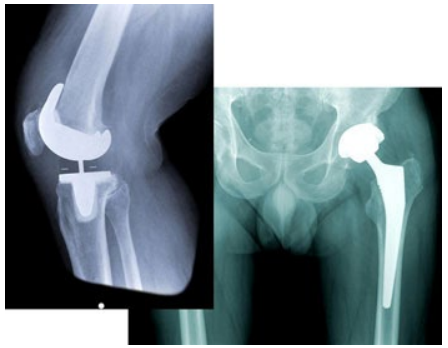


MSK conditions is the highest reason for years lived with disability (YLD)

Cost of Musculoskeletal diseases

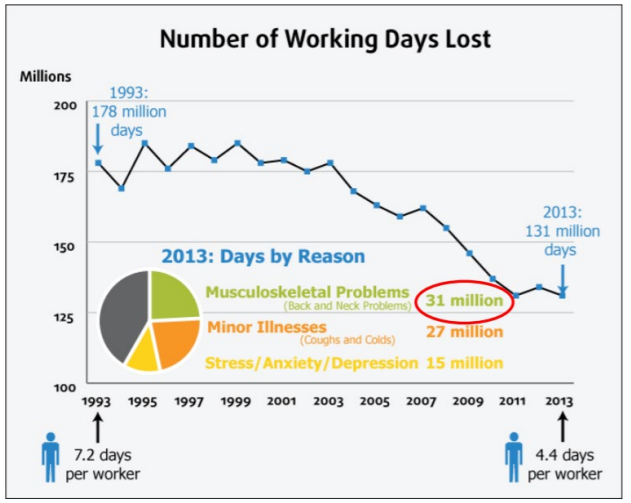


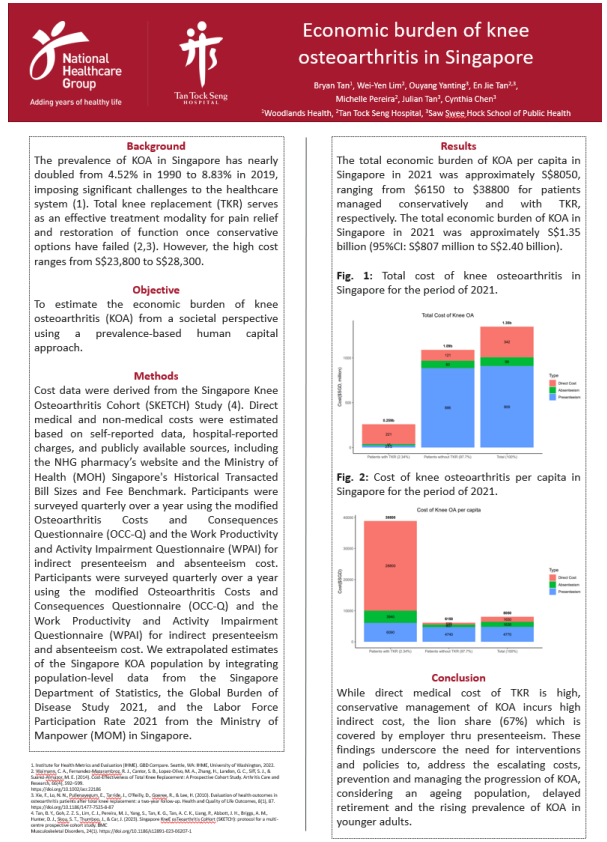




Musculoskeletal problems account for greatest loss of working days in UK

Labour Force Survey 2014, ONS





National Healthcare Group
Adding years of healthy life

Tan Tock Seng Hospital

Economic burden of knee osteoarthritis in Singapore

Bryan Tan[1], Wei-Yen Lim[2], Ouyang Yanting[4], En Jie Tan[2,4], Michelle Pereira[2], Julian Tan[3], Cynthia Chen[3]
[1]Woodlands Health, [2]Tan Tock Seng Hospital, [3]Saw Swee Hock School of Public Health

Background

The prevalence of KOA in Singapore has nearly doubled from 4.52% in 1990 to 8.83% in 2019, imposing significant challenges to the healthcare system (1). Total knee replacement (TKR) serves as an effective treatment modality for pain relief and restoration of function once conservative options have failed (2,3). However, the high cost ranges from S$23,800 to S$28,300.

Objective

To estimate the economic burden of knee osteoarthritis (KOA) from a societal perspective using a prevalence-based human capital approach.

Methods

Cost data were derived from the Singapore Knee Osteoarthritis Cohort (SKETCH) Study (4). Direct medical and non-medical costs were estimated based on self-reported data, hospital-reported charges, and publicly available sources, including the NHG pharmacy's website and the Ministry of Health (MOH) Singapore's Historical Transacted Bill Sizes and Fee Benchmark. Participants were surveyed quarterly over a year using the modified Osteoarthritis Costs and Consequences Questionnaire (OCC-Q) and the Work Productivity and Activity Impairment Questionnaire (WPAI) for indirect presenteeism and absenteeism cost. Participants were surveyed quarterly over a year using the modified Osteoarthritis Costs and Consequences Questionnaire (OCC-Q) and the Work Productivity and Activity Impairment Questionnaire (WPAI) for indirect presenteeism and absenteeism cost. We extrapolated estimates of the Singapore KOA population by integrating population-level data from the Singapore Department of Statistics, the Global Burden of Disease Study 2021, and the Labor Force Participation Rate 2021 from the Ministry of Manpower (MOM) in Singapore.

Results

The total economic burden of KOA per capita in Singapore in 2021 was approximately S$8050, ranging from $6150 to $38800 for patients managed conservatively and with TKR, respectively. The total economic burden of KOA in Singapore in 2021 was approximately S$1.35 billion (95%CI: S$807 million to S$2.40 billion).

Fig. 1: Total cost of knee osteoarthritis in Singapore for the period of 2021.

Fig. 2: Cost of knee osteoarthritis per capita in Singapore for the period of 2021.

Conclusion

While direct medical cost of TKR is high, conservative management of KOA incurs high indirect cost, the lion share (67%) which is covered by employer thru presenteeism. These findings underscore the need for interventions and policies to, address the escalating costs, prevention and managing the progression of KOA, considering an ageing population, delayed retirement and the rising prevalence of KOA in younger adults.

We set you thinking
TODAY
TUESDAY 23 OCTOBER 2018

Singapore World Big Read Opinion Visuals Brand Spotlight 8 DAYS

Musculoskeletal patients face highest risk of large hospital bills: Study

By NEO CHAI CHIN

Rapidly rising cost to patients and society

Mismatch in Funding and Burden

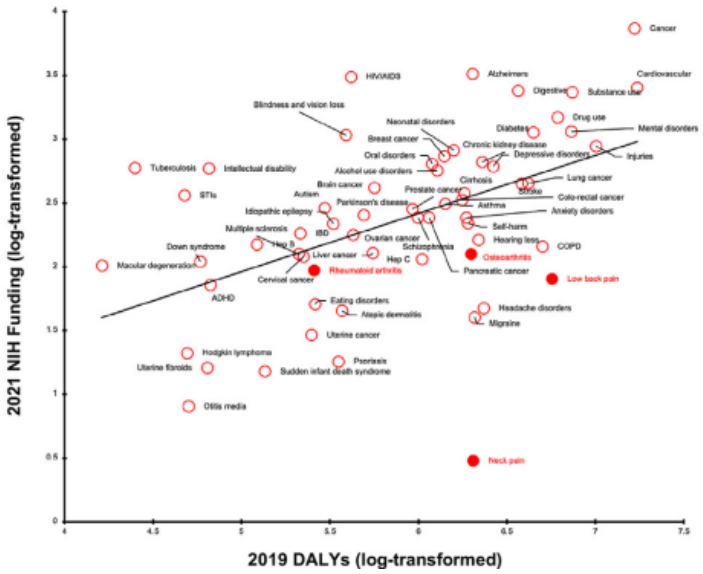
Musculoskeletal health: an ecological study assessing disease burden and research funding

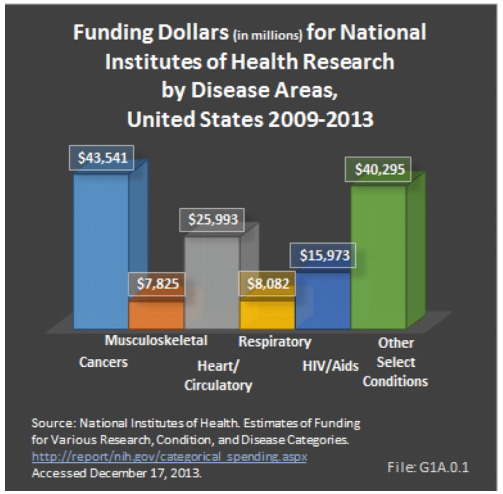
Andrew T. Nguyen,[a,b] Izzuddin M. Aris,[c] Brian D. Snyder,[a,b,f] Mitchel B. Harris,[a,d] James D. Kang,[a,e] Martha Murray,[a,f] Edward K. Rodriguez,[a,b] and Ara Nazarian[a,b,g,*]

Disease area	DALYs	Funding ($M)	U.S. prevalence		Spending per patient ($)
			Proportion[a]	Number	
Cardiovascular	17,266,977	2394	12.75%	39,669,218	60.35
Cancer	16,651,972	6520	8.50%	26,448,947	246.51
Injuries	10,129,922	897	26.25%	112,745,086	7.96
Musculoskeletal	**9,984,897**	**351**	**40.96%**	**127,411,125**	**2.75**
Drug use disorders	6,121,628	1621	3.44%	10,699,858	151.50
Low back pain	**5,697,152**	**170**	**16.75%**	**52,105,428**	**3.26**
COPD	5,021,538	112	6.48%	20,147,917	5.56
Diabetes	4,461,171	1099	12.49%	38,858,416	28.28
Lung cancer	4,186,491	419	0.14%	444,083	943.52
Hearing loss	2,187,374	163	22.73%	70,709,407	2.31
Neck pain	**2,043,518**	**2**	**6.81%**	**21,184,349**	**0.09**
Alzheimer's	2,026,882	2398	1.58%	4,902,695	489.12
Osteoarthritis	**1,986,343**	**85**	**16.67%**	**51,865,889**	**1.64**
Anxiety disorders	1,872,338	233	6.51%	20,241,173	11.51
HIV	415,325	3037	0.56%	1,743,128	1742.27
Rheumatoid arthritis	**257,884**	**94**	**0.52%**	**1,622,773**	**57.93**
Multiple sclerosis	211,385	111	0.13%	409,217	271.25

Funding values are represented as dollars in millions and rounded. Prevalence percentages in the table are calculated as a proportion of the total cases (311,050,916) and are presented alongside the actual number of cases. Spending per Patient ($) is determined by dividing funding (in millions and rounded) by the number of cases in 2019 U.S. prevalence. Abbreviations: DALY, disability-adjusted life year; COPD, chronic obstructive pulmonary disease. [a]The denominator utilized for prevalence is 311,050,916.

Table 1: NIH spending and prevalence for selected diseases, 2019.





NMRC National Medical Research Council Singapore

Scarce funding for musculoskeletal research

Mismatch

High incidence and burden of MSK disorders

The OF-LCG is open to proposals of the highest quality in all areas, typically involving multi-disciplinary teams. To better realise the goals of the Human Health and Potential (HHP) domain in Singapore, the following seven areas have been identified as national priorities for research:

- Cancers and neoplasms
- Cardiovascular
- Eye
- Infection
- Mental health
- Metabolic and endocrine
- Neurological

Disconnects in Musculoskeletal Healthcare

1

Biomedical vs Biopsychosocial

Emphasis of biomedical factors and *neglect of psychosocial determinants* of health in clinical assessments and treatment

2

Reactive vs Preventative Care

Understating preventative interventions that are proven to delay disease progression, while prioritising short-term fixes after patients present with symptomatic MSK diseases or injury,

3

Research vs Practice vs Policy

Lack of translation from research findings into clinical practice and policies that can promote system-level change

Disconnect 1

Why psychosocial factors?

BMC Musculoskeletal Disorders

BioMed Central

Research article

Open Access

The discordance between clinical and radiographic knee osteoarthritis: A systematic search and summary of the literature

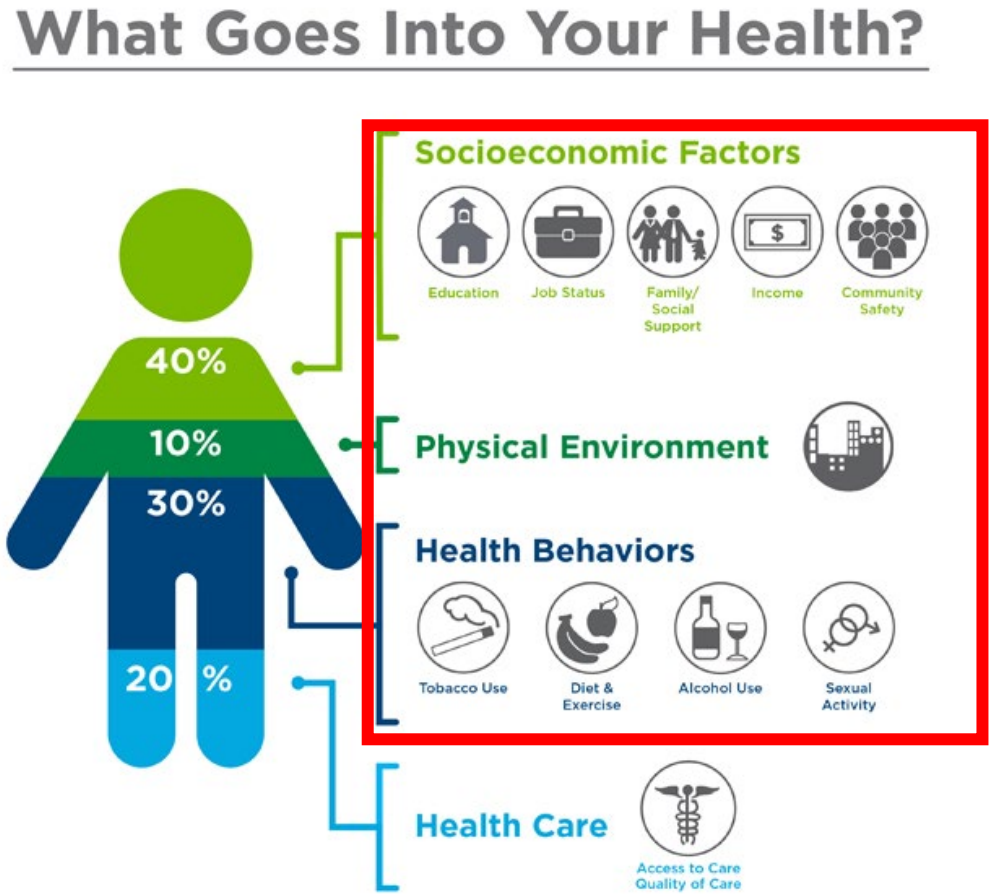
John Bedson* and Peter R Croft

International Orthopaedics (2020) 44:1971–2007
https://doi.org/10.1007/s00264-020-04607-9

ORIGINAL PAPER

Why are patients dissatisfied following a total knee replacement? A systematic review

Naoki Nakano[1,2] · Haitham Shoman[1] · Fernando Olavarria[1] · Tomoyuki Matsumoto[2] · Ryosuke Kuroda · Vikas Khanduja[1]



National Healthcare Group
Adding years of healthy life

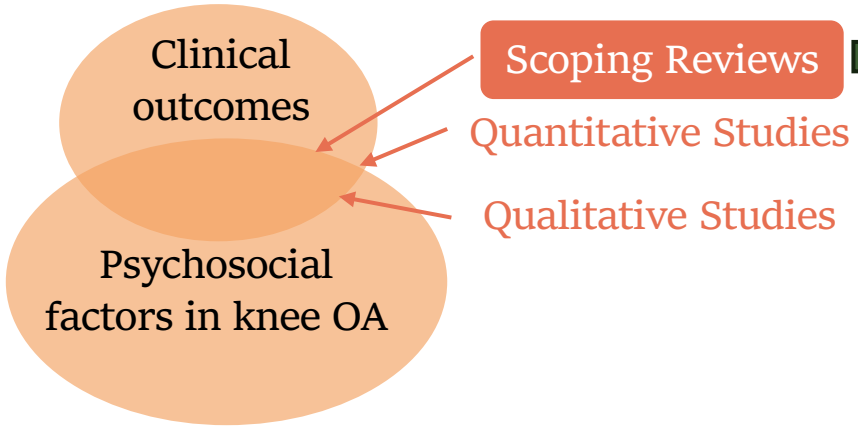
Woodlands Health
National Healthcare Group

LEE KONG CHIAN SCHOOL OF MEDICINE
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
Imperial College London

Disconnect 1

Understanding the role of psychosocial factors

Current strategies to facilitate understanding



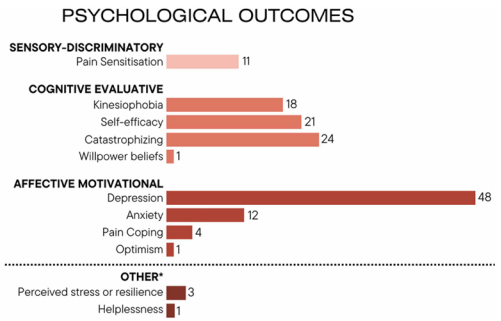
Osteoarthritis and Cartilage

OARSI OSTEOARTHRITIS RESEARCH SOCIETY INTERNATIONAL

Psychosocial factors in knee osteoarthritis: Scoping review of evidence and future opportunities

Bryan TAN Yijia # † * [1], Anthony Goff ‡ [1], Kham Vong Lang §, Sherlyn THAM Yen Yu ¶, Daisy SU Khaing Myint Zu †, Yasmin Lynda Munro †, Su-Yin YANG ‖, Leigh F. Callahan ##, Jocelyn L. Bowden †† ‡‡, Andrew M. Briggs §§, David J. Hunter †† ‡‡

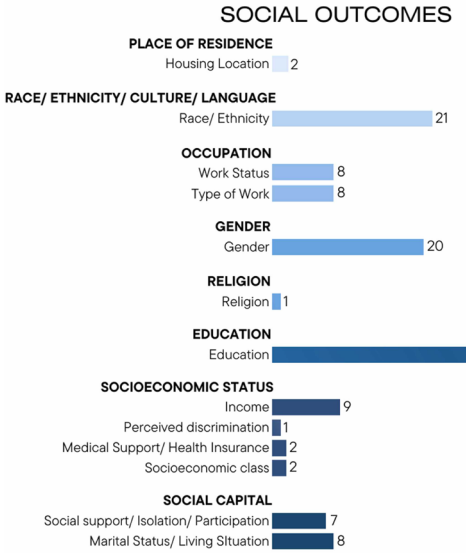
Identified psychosocial factors



Number of studies by United Nations regions

Suggestions for future research

1. Clearly define psychosocial factors of interest using established frameworks/models and measure them with validated measurement tools in quantitative studies
2. Undertaking of longitudinal studies tracking the variation of psychosocial factors over time and its influence on clinical outcomes
3. Extend outcomes beyond the traditional clinical outcome measures such as pain and physical function to measures like participation, productivity and healthcare utilization
4. Use of qualitative and mixed-methods study designs in conjunction with the traditional quantitative study designs
5. Inclusion of a broad range of both established and emerging combinations of psychological and social factors in all studies
6. Studying the role and impact of psychosocial factors in a variety of different geographical and cultural settings
7. Collaboration in multidisciplinary research and clinical teams in partnership with patients



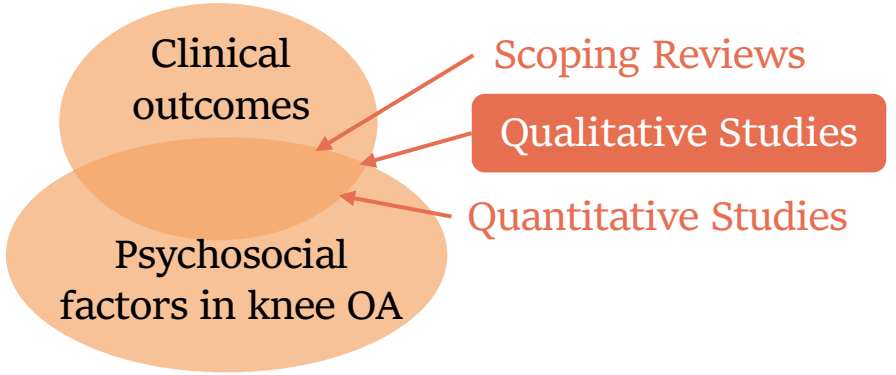
National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

LEE KONG CHIAN SCHOOL OF MEDICINE
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
Imperial College London

Disconnect 1

Understanding the role of psychosocial factors



SELECTED PROCEEDINGS FROM THE 2ND INTERNATIONAL CONSORTIUM FOR MUSCULOSKELETAL MENTAL AND SOCIAL HEALTH GUEST EDITORS DAVID RING MD, PHD AND ANA-MARIA VRANCEANU PHD

A Qualitative Study of Psychosocial Factors in Patients With Knee Osteoarthritis: Insights Learned From an Asian Population

Yang, Su-Yin PhD Health Psych (CPsychol)[1]; Woon, Eugene Yong Sheng MMC[2]; Griva, Konstadina PhD[2]; Tan, Bryan Yijia MBBS, MRCS(Edin), MMed(Ortho), FRCS(Ortho)[3]

Factors affecting experience, rehabilitation and recovery

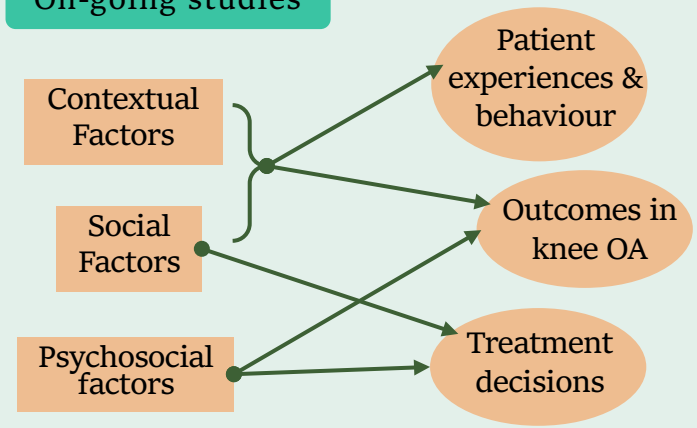
Psychological

- Loss of face due to knee OA
- Anticipation and avoidance of pain and suffering
- Vicious cycle of negative emotional experiences

Social

- Social and family support
- Built Environment
- Workplace environment and employment uncertainty

On-going studies



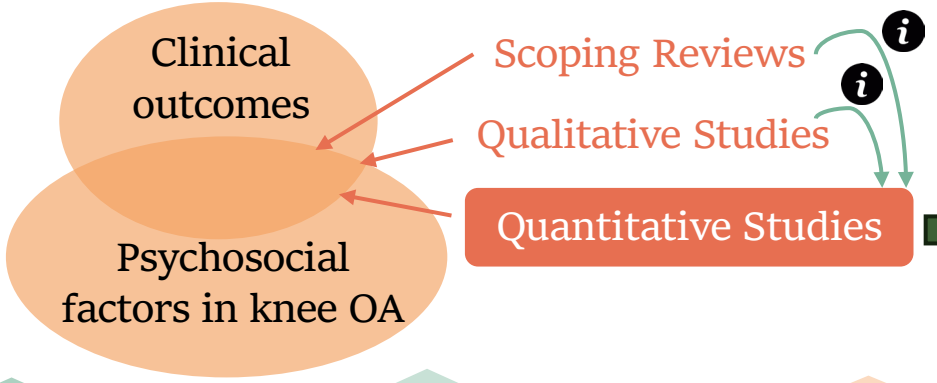
National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

LEE KONG CHIAN SCHOOL OF MEDICINE
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
Imperial College London

Disconnect 1

Understanding the role of psychosocial factors



Singapore KneE OsTeoarthritis CoHort Study

A 2-year community-primary-tertiary care cohort study examining how psychosocial and clinical factors influence outcomes in patients with knee osteoarthritis to enable early, targeted interventions.

SKETCH
INGAPORE KNEE OSTEOARTHRITIS COHORT STUDY

Community care
ntuc Health
St Luke's ELDERCARE

Primary care
National Healthcare Group POLYCLINICS

Tertiary Care
Tan Tock Seng Hospital
Singapore General Hospital
Sengkang General Hospital SingHealth
Woodlands Health National Healthcare Group

STUDY PROTOCOL Open Access

Singapore KneE osTeoarthritis CoHort (SKETCH): protocol for a multi-centre prospective cohort study

N=1500

$1.95M
NMRC National Medical Research Council Singapore
POPULATION HEALTH RESEARCH GRANT


Asst. Prof. Bryan Tan
Woodlands Health National Healthcare Group


Dr. Michael Yam
Tan Tock Seng Hospital National Healthcare Group


Dr. Matthew Tay
Tan Tock Seng Hospital National Healthcare Group


Prof. Julian Thumboo
Singapore General Hospital


Dr. Pua Yong Hao
Singapore General Hospital


Dr. Lincoln Liow
Singapore General Hospital


Linus Tan
Sengkang General Hospital SingHealth

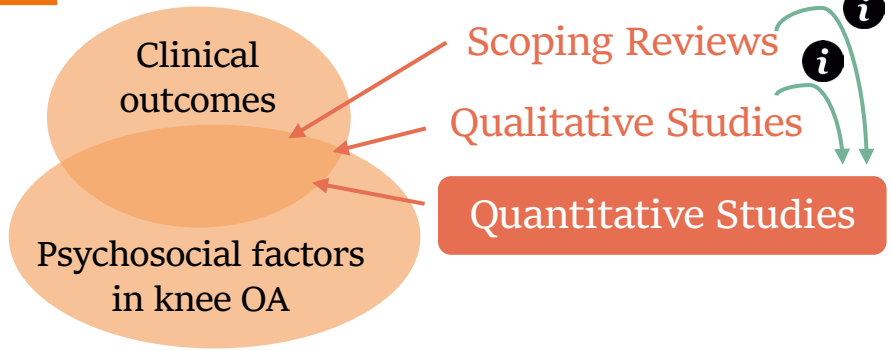

Assoc. Prof. Richard Lee


Prof. James Hui
National University Hospital
KIV

ntuc Health
National Healthcare Group POLYCLINICS
National Healthcare Group Adding years of healthy life
SingHealth Defining Tomorrow's Medicine
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
LEE KONG CHIAN SCHOOL OF MEDICINE
National University Hospital
KIV

Disconnect 1

Understanding the role of psychosocial factors

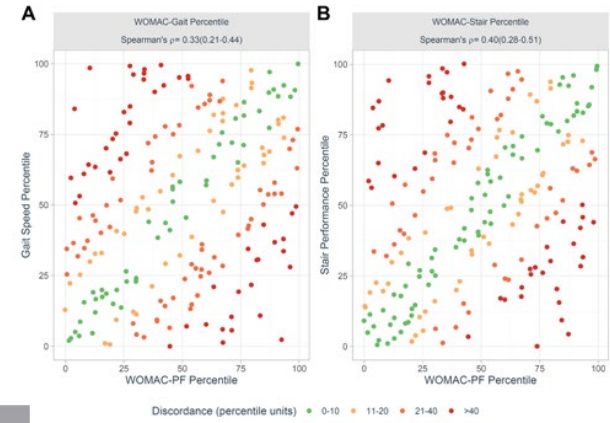


Discordance Between Self-Reported and Performance-Based Physical Function in Patients Who Have Knee Osteoarthritis: Associations With Pain Intensity and Negative Affect

Yong-Hao Pua, PhD [a, b, *], Bryan Yijia Tan, MD [c, d], Juanita Low, BPhty [a], Ee-Lin Woon, BPhty [a], Seng-Jin Yeo, MD [e], Ross A. Clark, PhD [f], Janet P. Bettger, ScD [g], Michelle J. Pereira, PhD [h], Chun-Yue Tan, BS [c], Julian Thumboo, MD [b, i, j]

Key messages

- Large proportion of patients reported greater physical disability than observed
- Pain and anxiety intensity were meaningful predictors of this discordance



SKETCH
SINGAPORE KNEE OSTEOARTHRITIS COHORT STUDY

RESEARCH Open Access

A cross sectional study exploring the relationship of self-reported physical activity with function, kinesiophobia, self-efficacy and quality of life in an Asian population seeking care for knee osteoarthritis

Anthony J. Goff[1], Lester E. Jones[1,2], Chien Joo Lim[3] and Bryan Yijia Tan[3*]

Key messages

- Large proportion of people have low physical activity levels
- Correlation between physical activity and kinesiophobia
- Ethnic, gender and age differences in inactivity

Research | Open access | Published: 26 March 2025

Assessing the quality of care for knee osteoarthritis in Singapore: a cross-sectional study

Ren Hao Linus Tan, Anthony J. Goff, Chien Joo Lim & Yijia Bryan Tan

BMC Musculoskeletal Disorders 26, Article number: 298 (2025) | Cite this article

Key messages

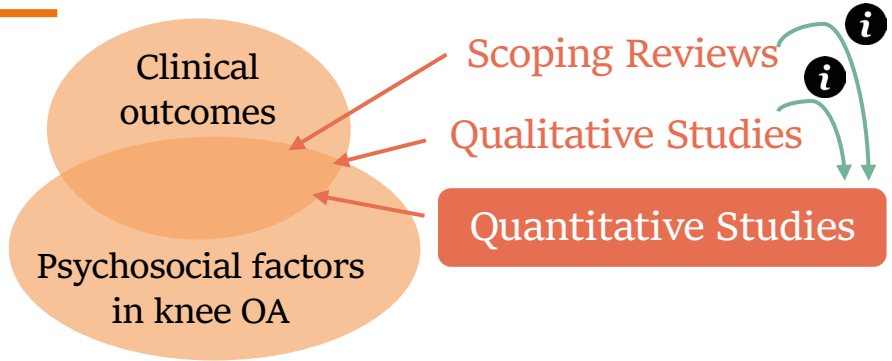
- Quality of care is suboptimal
- Quality of care does not account for long-term clinical outcomes

ntuc Health | National Healthcare Group POLYCLINICS | National Healthcare Group Adding years of healthy life | SingHealth Defining Tomorrow's Medicine | NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE | LEE KONG CHIAN SCHOOL OF MEDICINE

Disconnect 1

Understanding the role of psychosocial factors

SKETCH
SINGAPORE KNEE OSTEOARTHRITIS COHORT STUDY



FEATURED ARTICLES

How Does Shame Relate to Clinical and Psychosocial Outcomes in Knee Osteoarthritis?

Yeo, Jia Ying MSc[1]; Lim, Chien Joo MSc[2]; Yang, Su-Yin PhD Health Psych (CPsychol)[3]; Tan, Bryan Yijia MBBS, MRCS(Edin), MMed(Ortho), FRCS(Ortho)[2]

Key messages

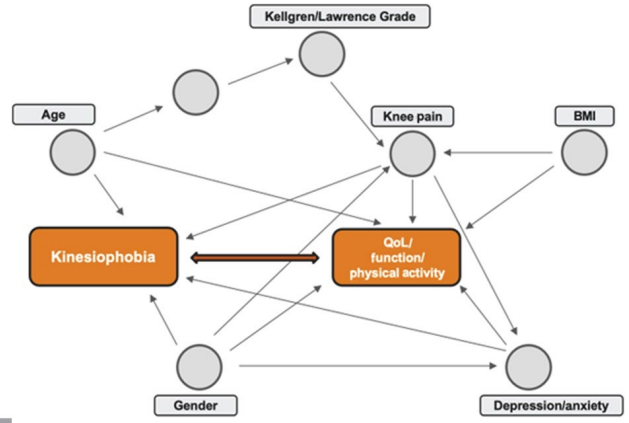
- Shame has an association with clinical and psychosocial outcomes
- Higher BMI is linked to increased shame

Is Kinesiophobia Associated With Quality of Life, Level of Physical Activity, and Function in Older Adults With Knee Osteoarthritis?

Shaun Kai Kiat Chua MBBS[1], Chien Joo Lim MSc[2], Yong Hao Pua PhD[3], Su-Yin Yang PhD (CPsychol)[4,5], Bryan Yijia Tan MBBS, MRCS(Edin), MMed(Ortho), FRCS(Ortho), PhD[2]

Key messages

- Kinesiophobia was associated with poorer QoL and physical activity
- Anxiety and depression was positively correlated with kinesiophobia

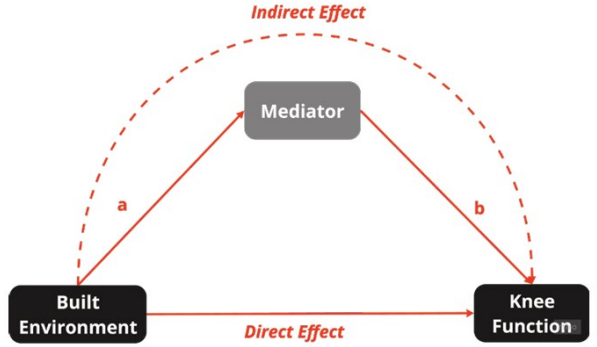


BMJ Open Exploring the role of the built environment and psychosocial mediators on knee function in knee osteoarthritis patients in Singapore: a cross-sectional study

Razeena Sahrin [1], Claire Jia Yi Ng,[2] Chien Joo Lim [1], Zack Zhong Sheng Goh,[1] Yong-Hao Pua,[3] Bryan Yijia Tan[1,2]

Key messages

- More accessible BE is correlated with knee function
- Self-efficacy mediates the relationship between BE accessibility and knee function
- Fear of movement mediates the negative association between barriers in the BE and knee function



ntuc Health · National Healthcare Group POLYCLINICS · National Healthcare Group Adding years of healthy life · SingHealth Defining Tomorrow's Medicine · NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE · LEE KONG CHIAN SCHOOL OF MEDICINE

Disconnect 1

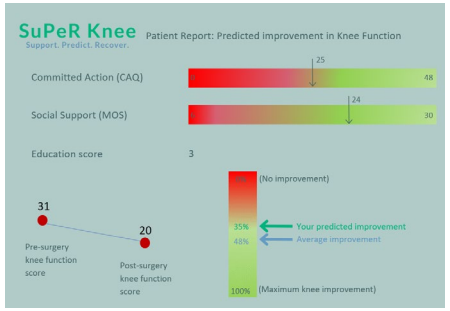
Developing Clinical Decision Support Tools

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

SuPeR Knee Australia

Support. Predict. Recover

Understanding and predicting recovery in patients undergoing TKR



SuPeR Knee Singapore

Developing and validating a biopsychosocial clinical decision support tool using artificial intelligence and machine learning for knee OA patients

$200K

National Healthcare Group
Adding years of healthy life

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

Local Datasets

- CONNACT RCT
- HarmoKnee RCT
- SKETCH Cohort

Non-surgical

- TKR Registry

- TKR Registry
- TKR Psychosocial Cohort
- TKR HUAT-R RCT

TKR

Asst. Prof. Bryan Tan

National Healthcare Group

Dr. Lynn Thwin

Tan Tock Seng Hospital

Dr. Daniel Hap

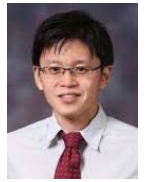
Tan Tock Seng Hospital

Assoc. Prof. Lincoln Liow

Singapore General Hospital

Assoc. Prof. Katy Leung

Singapore General Hospital



Dr. Pua Yong Hao

Singapore General Hospital

CENTRE FOR REHAB INNOVATIONS

THE UNIVERSITY OF NEWCASTLE AUSTRALIA

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

HMRI Hunter Medical Research Institute

National Healthcare Group
Adding years of healthy life

Disconnect 1

Understanding the role of psychosocial factors

Next Steps

Moving from a knee OA population to a fracture population

2018-2020

SPHEER 1.0

Focus on clinical, radiographic factors and the role of rehab (n=200)

Research | Open access | Published: 02 October 2023

Study on proximal humerus evaluation of effective treatment (SPHEER) – what is the effect of rehabilitation compliance on clinical outcomes of proximal humerus fractures

Ming Foo Kenneth Nah, Michelle Jessica Pereira, Mani Hemaavathi, Shiyun Winnie Wong, Chien Joo Lim & Bryan Yijia Tan

Article • *Open access*

Achieving satisfactory functional outcomes in conservatively treated proximal humerus fractures: relationship between shoulder range of motion and patient-reported clinical outcome scores

Ong, P.W., Lim, C.J., Pereira, M.J., Kwek, E.B.K., Tan, B.Y.

JSES International, 2024, 8(3), pp. 440–445

Evaluating the association of radiographic parameters of proximal humerus fractures managed conservatively with functional outcomes

Joshua Song · Lim Chien Joo · Low Chee Chung Jonathan · Sean Wei Loong Ho · Ivan Chua · Ernest Beng Kee Kwek · Bryan Yijia Tan

Deltoid tuberosity index for proximal humerus fracture: reliability and a predictor of systemic osteoporosis in an Asian population

Wei Xiang Ng, MBBS, MRCS(Ireland), Sanchalika Acharyya, BSc, MSc, PhD, MPH, Shirong Huang, MBBS, MRCS(England), Ernest Beng Kee Kwek, MBBS, MRCS(Edin), MMed(Ortho), FAMS, FRCS(Edin), Bryan Yijia Tan, MBBS, MRCS(Edin), MMed(Ortho), FRCS(Ortho)

JSES International • *Open Access* • Volume 7, Issue 5, Pages 743 - 750 • September 2023

Social determinants of outcomes in nonoperatively treated proximal humerus fractures

Chua, Shaun Kai Kiat; Soh, Qian Ying; Lim, Chien Joo; Ring, David; Chua, Ivan Tjun Huat; Kwek, Ernest Beng Kee; Tan, Bryan Yijia

Key messages

- People recovering from PHF experience less incapability in proportion to their social independence (employment, caregiver, care facility)

Scoping review

Qualitative Study

AO Trauma Asia Pacific Research Grant

2025 onwards

SPHEER 2.0

Focus on psychosocial factors and predictive effect on fractures

NHG-LKC Clinician Scientist Preparatory Programme (CSPP) *part of FHT2

Disconnect 1

Understanding the role of psychosocial factors

National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Woodlands Health Insights into System and Patient Engagement Refinement: A Qualitative Study

NORTHERN REGION

86% Residents below 65 years old

Lowest chronic screening participation

88% screened had at least one chronic disease-related abnormality

Among diabetics, **66.9%** did not meet optimal blood sugar control target

Highest rate: Obesity, Daily smoking, Suboptimal lipid control
> heart attack, stroke, kidney failure, lower limb amputations

Working with HABITS and WH's nurses, WHISPER aims to **elicit hospital and individual factors** influencing WH patients' **health beliefs, behaviours, and care experiences** to **develop strategies** that **improve their treatment journey, compliance, and outcomes.**

DELIVERABLES

- Promote preventive health and increase chronic screening uptake regionally
- Enhance self-management and reduce chronic condition prevalence for long-term community health
- Partner with social services to support sustained health (e.g. financial aid, transport, community resources)

Disconnect 1

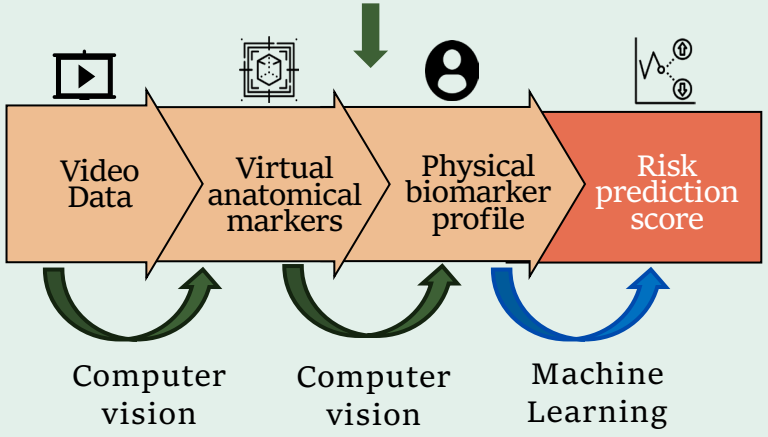
Quantifying Human Movement

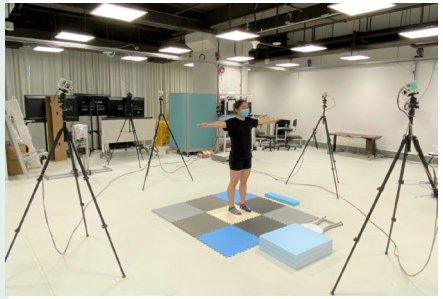
RRIS *Rehabilitation Research Institute of Singapore*

Largest Motion Capture Dataset in Asia

N=695

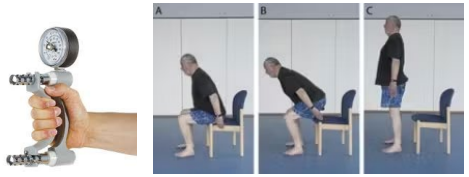
12 Clinically relevant tasks





White Paper: "Walking Speed: the Sixth Vital Sign"

Steven Fritz, PT, PhD[1] Michelle Lusardi, PT, PhD[2]



Gait-Based Biomechanical Predictors of Future Falls in Singaporean Adults: A Pilot Study

Roberts O[1], Wu T L[1], Saravanan H[1], Er C[12], Cheng J[3], Choo N[3], Sim I[3], Poh EJ[3], Cheong Z[3], Tan B Y[123].

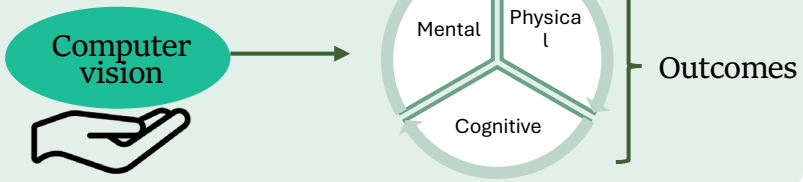
Table 2: Final Model Performance.

	AUC	95% CI AUC	Sensitivity	Specificity
M_6	0.8	0.702-0.887	0.78	0.63

Table 3: M_6 Coefficients. *p < 0.05, ** p < 0.01

	Predictor	Odds Ratio (95% CI)	p-value
M_6	Hip_Ext_Sta	2.44 (1.36 – 4.38)	**0.003****
	Stride_Length_SD	0.50 (0.26 – 0.95)	**0.034***
	Age	1.65 (0.96 – 2.84)	0.073
	ArmSwi	2.07 (1.14 – 3.75)	**0.016***
	Stance_Time_SI	1.75 (1.00 – 3.05)	**0.050***
	TorsoTilt	0.59 (0.33 – 1.06)	0.076

Ongoing scoping review



RESEARCH ARTICLE

See your mental state from your walk: Recognizing anxiety and depression through Kinect-recorded gait data

Nan Zhao[1], Zhan Zhang[1,2], Yameng Wang[1,2], Jingying Wang[1], Baobin Li[2], Tingshao Zhu[1]*, Yuanyuan Xiang[1]

Machine vision-based gait scan method for identifying cognitive impairment in older adults

Yuzhen Qin[1], Haowei Zhang[2], Linbo Qing[1], Qinghua Liu[1], Hua Jiang[3], Shen Xu[4], Yixin Liu[5,6]* and Xiaohai He[1]*

Asst. Prof. Bryan Tan

RRIS

Dr. Matthew Tay

Tan Tock Seng Hospital, National Healthcare Group

Oliver Roberts

RRIS

Dr Prayook Jatesiktat

Nanyang Technological University Singapore

Assoc. Prof. Ang Wei Tech

Nanyang Technological University Singapore

RRIS · Nanyang Technological University Singapore · Woodlands Health, National Healthcare Group · Centre for Healthcare Innovation · National Healthcare Group, Adding years of healthy life · CMT, Enabling Innovation through MedTech, Centre for Medical Technologies & Innovations · National Healthcare Group Polyclinics · Ministry of Health Singapore · TRUST · Tan Tock Seng Hospital

Disconnect 1

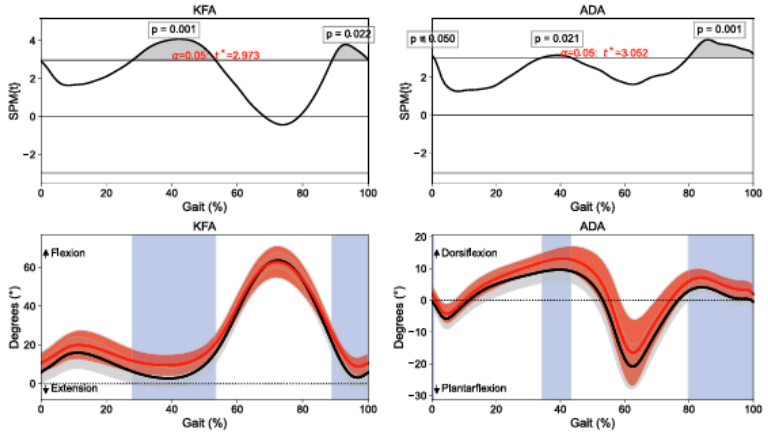
Quantifying Human Movement

Biomechanical differences of Asian knee osteoarthritis patients during standing and walking using statistical parametric mapping: A cross-sectional study

Yi Hu [a], Phillis Teng [c], Tsung-Lin Wu [b], Ross Clark [d], Yong-Hao Pua [e], Oliver Roberts [b], Jia Wei Yong [b], Amr Alhossary [b], Lek Syn Lim [b], Desmond Y.R. Chong [f], Wei Tech Ang [b], Bryan Yijia Tan [a,b,g,*]

Key messages

Knee OA group had greater standing knee flexion angles (KFA) and ankle dorsiflexion angles (ADA), walking KFA and ADA during terminal stance, and walking ADA during mid to terminal swing

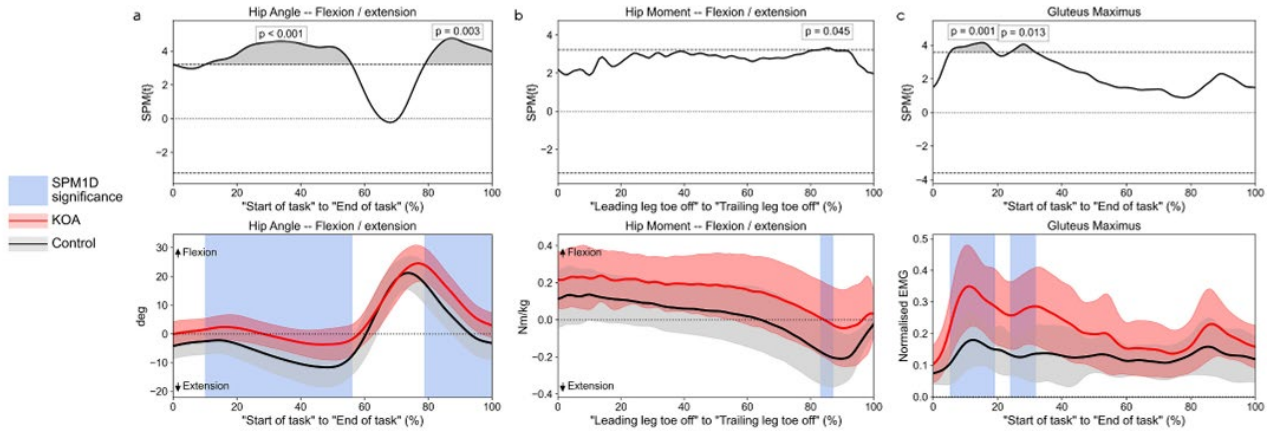


Biomechanical analysis of step-up and step-down tasks in knee osteoarthritis: Insights from leading and trailing limbs

Oliver Roberts [a,*], Tsung-Lin Wu [a], Phillis Teng [b], Jun Liang Lau [c], Yong Hao Pua [d], Ross A. Clark [e], Yi Hu [f], Bryan Yijia Tan [a,g]

Key messages

- Knee OA participants demonstrated kinematic, kinetic and electromyography variance
- Step-down induced elevated external knee adduction moments in the knee OA group

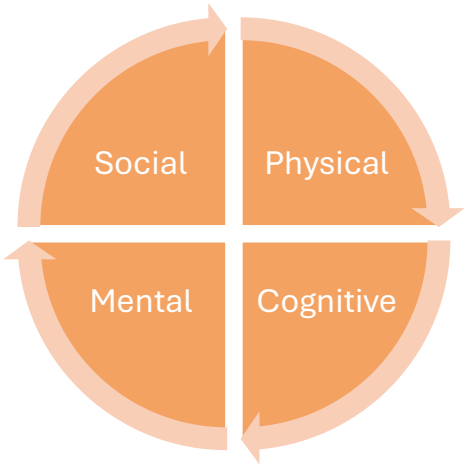


RRIS NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE Woodlands Health National Healthcare Group

Disconnect 1

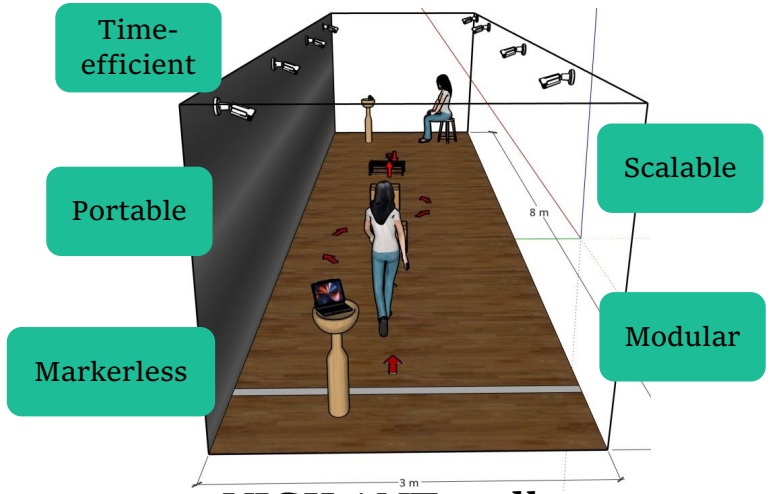
Quantifying Human Movement

Developing an AI-driven rapid assessment of physical biomarkers to predict and screen bio-psychosocial future bio-psychosocial health outcomes

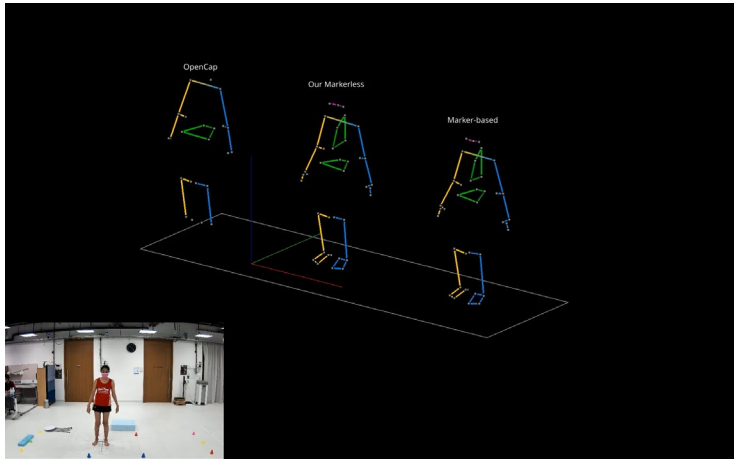


VIGILANT

Vision-InteGrated InteLligent AssessmeNT



VIGILANT walkway



Asst. Prof. Bryan Tan

RRIS

Dr. Matthew Tay

Tan Tock Seng Hospital

Oliver Roberts

RRIS

Dr Prayook Jatesiktat

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Assoc. Prof. Ang Wei Tech

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

RRIS · NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE · Woodlands Health National Healthcare Group · Centre for Healthcare Innovation · National Healthcare Group · CMT Centre for Medical Technologies & Innovations · National Healthcare Group Polyclinics · Ministry of Health Singapore · TRUST · Tan Tock Seng Hospital

Disconnects in Musculoskeletal Healthcare

1

Biomedical vs Biopsychosocial

Emphasis of biomedical factors and *neglect of psychosocial determinants* of health in clinical assessments and treatment

2

Reactive vs Preventative Care

Understating preventative interventions that are proven to delay disease progression, while prioritising short-term fixes after patients present with symptomatic MSK diseases or injury,

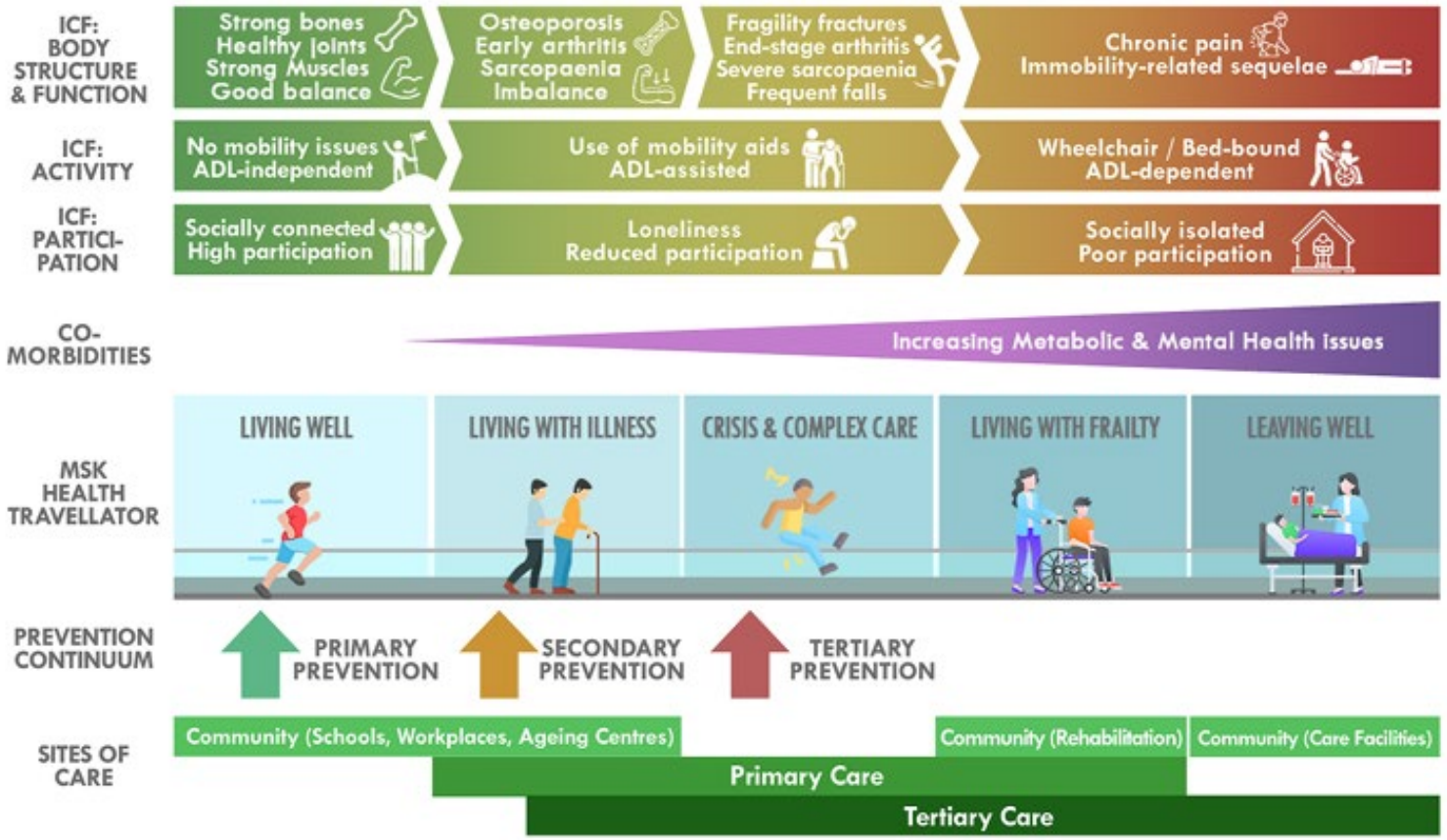
3

Research vs Practice vs Policy

Lack of translation from research findings into clinical practice and policies that can promote system-level change

Disconnect 2

A life-course approach to MSK physical health



emerald PUBLISHING
Journal of Integrated Care

Taking a life-course and integrated approach to musculoskeletal and physical health in Singapore

Bryan Yijia Tan, Andrew Ian-Hong Phua, Ivy Wei Fang Ho, Aidan Lyanzhiang Tan, Shieh Yng Lian, Clive Tan, Chin Sim Teoh, Soon Yin Tjan, Yew Yoong Ding and Tock Han Lim

Features of Framework

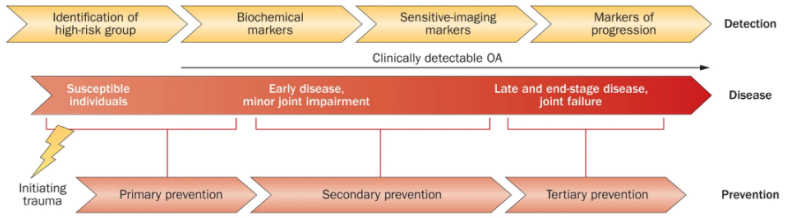
- Life-course approach to MSK in a broad physical health context
- Movement from disease-based perspective to holistic patient-centred perspective
- Demonstration of interaction between body function with activity levels and social participation
- Recognition of metabolic and mental health issues accompanying physical health
- Identification of intervention opportunities across primary-secondary-tertiary prevention continuum

Disconnect 2

A life-course approach to MSK physical health

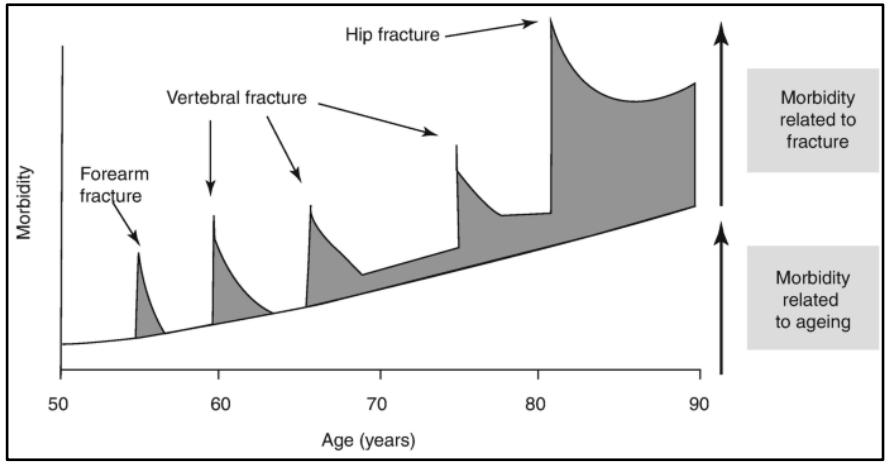
Figure 2: The OA continuum.

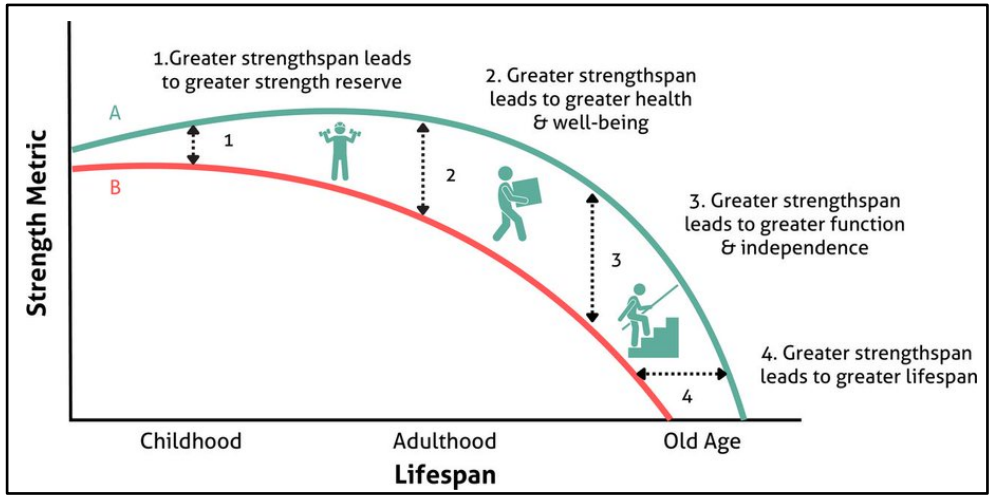
From: Strategies for the prevention of knee osteoarthritis



Nature Reviews | Rheumatology

OA develops slowly, taking 10–15 years to develop from a known initiating trauma. Different techniques can be used to identify individuals at risk of OA and those with early-stage and late-stage disease. For knee OA, primary prevention includes the prevention of knee injury. Secondary prevention includes dietary intervention and exercise in individuals who are overweight, have impaired muscle function or prior joint injury, whereas tertiary prevention involves early treatment of OA to prevent progression of the disease. Abbreviation: OA, osteoarthritis.





Public Health Approach to MSK disease

Arthritis Research UK

MUSCULOSKELETAL HEALTH

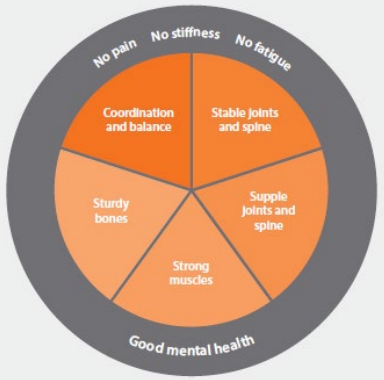
A public health approach

Musculoskeletal condition	Intervention
Low back and neck pain	Stay physically active and exercise regularly, e.g. through a group exercise programme Weight loss support (if required)
Falls	Strength and balance training Home hazard assessment Participation in falls prevention programmes such as Otago and FaME Activities such as tai chi, dancing or gardening
Osteoarthritis	Activity and exercise to strengthen muscles and improve aerobic fitness, such as walking, swimming or pilates Weight loss support (if required)

6.2 Appendix 2: Levels of prevention in musculoskeletal health

	Examples: Systemic inflammatory conditions (e.g. Rheumatoid arthritis).	Examples: Conditions of musculoskeletal pain (e.g. Osteoarthritis, back pain).	Examples: Fragility fractures and osteoporosis.
Primary prevention (Reducing the risk of the condition developing).	Reducing smoking prevalence to reduce the proportion of people who develop rheumatoid arthritis.	Reducing obesity across the whole population to reduce the number of people who develop osteoarthritis and back pain.	Increasing high impact physical activity in childhood to reduce risk of fractures in adult life.
		Increasing appropriate physical activity across the whole population to reduce the number of people who develop osteoarthritis and back pain.	Identifying adults who are at high risk of a fracture (for example due to medication, or illness) and promoting adequate nutrition, increasing physical activity and considering medication.
Secondary prevention (Stopping condition worsening once it has developed).	Rapid referral of people with early rheumatoid arthritis to begin urgent, intensive therapy to control the disease and prevent joint damage.	Increasing physical activity among people with osteoarthritis and back pain to reduce pain and disability in people with these conditions.	Ensuring that people who have had a fragility fracture receive treatment and support to prevent another fracture.
	Cardiovascular risk screening and bone health assessment for people with rheumatoid arthritis.	Decreasing obesity among people with osteoarthritis and back pain to reduce pain and disability in people with these conditions.	
Tertiary prevention (Reducing the impact of the condition on the person affected).	Services such as podiatry, physiotherapy and occupational therapy to help people remain active and independent.	Occupational health services to support people to remain at, or to return to, work.	Promoting recovery from fracture with re-enablement services after a hip fracture to support return to independent living.

Figure 2: Factors comprising musculoskeletal health



Assessing the built environment

Built Environment in Falls and OsteoarthrITis

A multi-method study assessing the interplay among knee OA, falls, the BE, and psychosocial factors and outcomes in mobility-challenged adults

BE-FIT

BUILT ENVIRONMENT IN FALLS & ARTHRITIS

$5M

National Research Foundation
Prime Minister's Office
Singapore

CREATE THEMATIC GRANT CALL 2022

"INTERSECTION OF PUBLIC HEALTH AND THE ENVIRONMENT"

SKETCH
SINGAPORE KNEE OSTEOARTHRITIS COHORT STUDY

Osteoarthritis + Falls +

Interactions between the **Built Environment** and **Psychosocial Factors**

Impact on **Physical Activity**, **Social Participation** and **Functional Outcomes**

Deliverables

- Inform urban design and public health policies
- Propose actionable co-developed recommendations for age-friendly environments
- Validation of EAT-Lite Tool for mobility-challenged elderly
- Shared GIS/GPS data platform on BE between governmental agencies

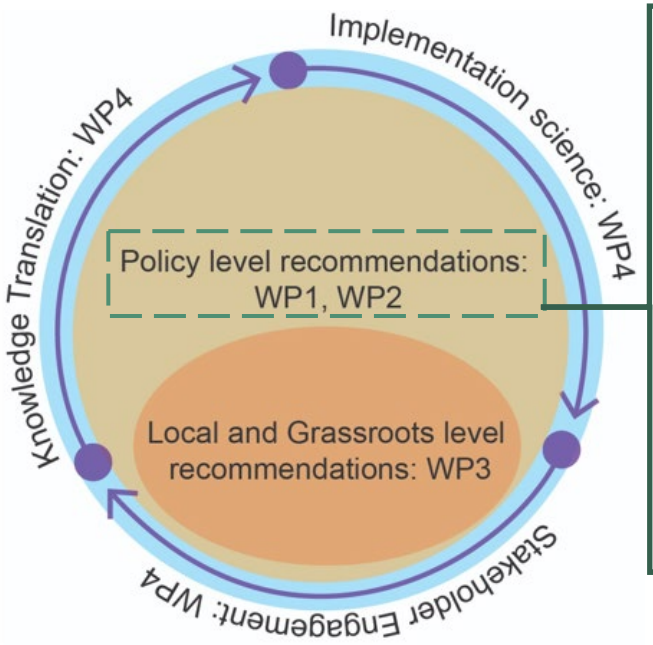
National Healthcare Group · ETH · RRIS · SingHealth Defining Tomorrow's Medicine · Geriatric Education & Research Institute · MOHT · MOH Office for Healthcare Transformation

Disconnect 2

Disconnect 1

Assessing the built environment

BE-FIT
BUILT ENVIRONMENT IN FALLS & ARTHRITIS



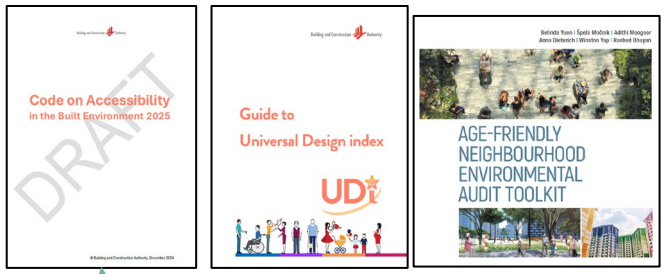
WP1 **Qualitative study**

Understanding the individual, contextual and BE factors

Individual
Contextual
BE
Factors

Psychosocial
Participation
Outcomes

Findings to inform relevant guidelines, codes and environmental audit toolkits



Provided feedback from preliminary findings to BCA's Draft Code on Accessibility 2025

WP2 **Quantitative study**

Exploring the associations: BE factors, physical activity levels, clinical outcomes, psychosocial factors

Role of Kinesiophobia in mediating the relationship between knee function and life space utilization among patients with knee Osteoarthritis and Falls

Neha Seayad[1], Isaac Okumura Tan[1], Lim Chien Joo[2] and Tan Yijia Bryan [1,2]

[1]Rehabilitation Research Institute of Singapore (RRIS), Nanyang Technological University
[2]Department of Orthopaedic Surgery, Woodlands Health Campus, National Healthcare Group

I-MESH
INTERNATIONAL MUSCULOSKELETAL MENTAL & SOCIAL HEALTH CONSORTIUM

Presentation of preliminary findings at I-MESH


Asst. Prof. Bryan Tan


Dr. Yang Su- Yin


Dr. Su Su


Dr. Joanne Kua


Prof. Belinda Yuen


Assoc. Prof. Tim Xu


Dr. Tan Weng Mooi


Dr. Noor Hafizah


Assoc. Prof. Ng Yee Sian


Assoc. Prof. Angelique Chan

National Healthcare Group
Adding years of healthy life

RRIS

MOHT
MOH OFFICE FOR HEALTHCARE TRANSFORMATION

SUTD
SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

SIT
SINGAPORE INSTITUTE OF TECHNOLOGY

DukeNUS
Medical School

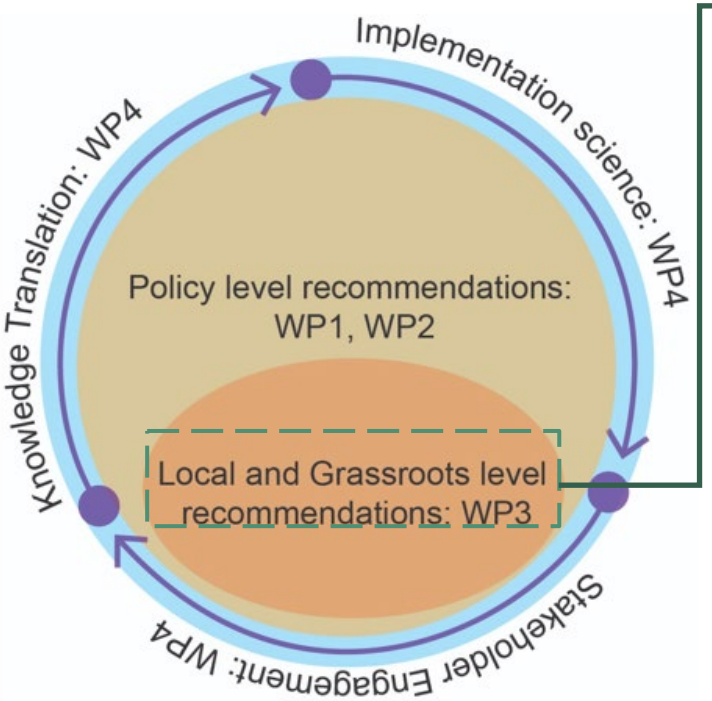
SingHealth
Defining Tomorrow's Medicine

Disconnect 2

Disconnect 1

Assessing the built environment

BE-FIT
BUILT ENVIRONMENT IN FALLS & ARTHRITIS



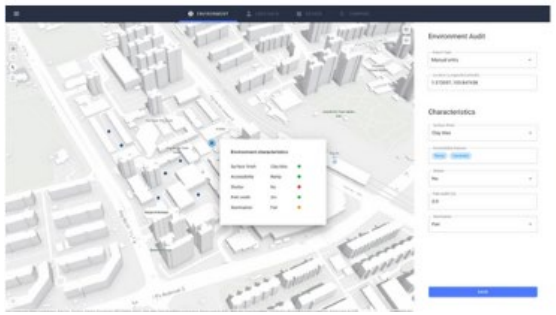
WP3 Yio Chu Kang-specific multi-method study

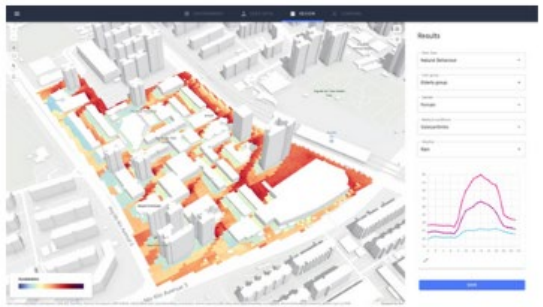
Geospatial mapping, qualitative exploration, wearable based visualisation

Qualitative
- Community Improvement Walk
- Photovoice

Technological Geospatial
- Naturalistic observation
- Sensor technology

Collaboration with NParks





Synthesis of data to form heatmap for YCK


Asst. Prof. Bryan Tan


Dr. Yang Su- Yin


Dr. Navrag Singh


Dr. Tan Weng Mooi


Asst. Prof. Panayotis Mavros


Dr. Heiko Aydt


Prof. Christoph Hoelscher

National Healthcare Group
Adding years of healthy life

RRIS

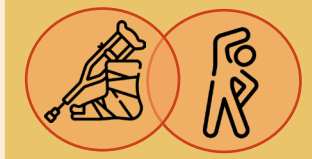
MOHT
MOH OFFICE FOR HEALTHCARE TRANSFORMATION

TELECOM Paris

IP PARIS

ETH

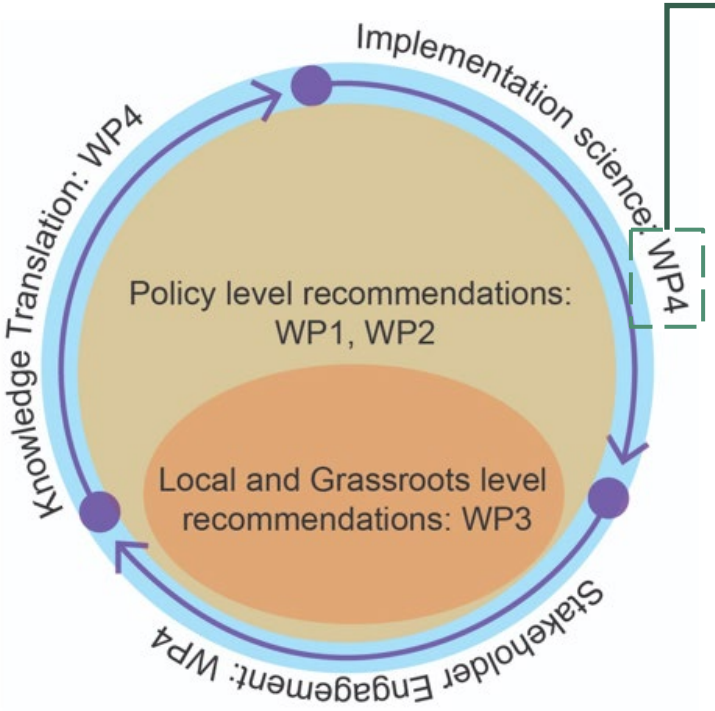
Disconnect 2



Disconnect 1

Assessing the built environment

BE-FIT
BUILT ENVIRONMENT IN FALLS & ARTHRITIS



WP4 Stakeholder engagement

Policymaker engagement and co-developing recommendations

Stakeholders:

Urban Planner & Policy Makers

- Urban Redevelopment Authority
- National Parks
- Land Transport Authority
- Housing & Development Board
- MOHT
- Building and Construction Authority

Academics

- SUTD Lee Kuan Yew Centre for Innovative Cities
- Duke-NUS Medical School
- Centre for Ageing Research & Education
- SIT Singapore Institute of Technology

Clinicians

- National Healthcare Group
- SingHealth

Grassroots

- People's Association

Asst. Prof. Bryan Tan

Assoc. Prof. Ding Yew Yoong

Co-developing recommendations for barrier-free design of the BE

→ Heathy Environment Symposium to be conducted in early 2026

National Healthcare Group
Adding years of healthy life

RRIS

MOHT
MOH OFFICE FOR HEALTHCARE TRANSFORMATION

ETH

Geriatric Education & Research Institute

Disconnect 3

Disconnect 2

Predictions and Interventions for falls and fracture risks

Future Health Technologies 2 (FHT2)

National Healthcare Group — Adding years of healthy life

ETH zürich

Scalable, cost-effective, technology-driven ***healthcare solutions*** *to enhance functional ability*

Program Leaders

Sowjanya Kallakuri

Benedikt Helgason

Nicole Wenderoth

Bryan Tan

National Healthcare Group — Adding years of healthy life

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

DukeNUS Medical School

NUS National University of Singapore

ETH zürich (SEC) SINGAPORE-ETH CENTRE

BOND UNIVERSITY

NUHS

Ralph Müller

Bryan Tan

Victor Schinazi

Nagaendran Kandiah

Olivier Lambercy

Karen Chua

	V1 Musculoskeletal Health and Mobility	V2 Mental and Cognitive Health	V3 Rehabilitation and Recovery
Digital Behavioural Interventions	* Fall risk assessment * Fracture risk assessment * Composite risk scores and risk communication * Fall prevention * Fracture prevention * Continuous value assessment	* Precision Digital Therapeutics * Mental resilience interventions * Cognitive Impairment assessment and support.	* TAILOR platform for stroke rehabilitation * Soft robotics for therapy * Chatbot support * SmartVNS neurostimulation
Data Science and Artificial Intelligence			

CREATE

Campus for Research Excellence And Technological Enterprise

NATIONAL RESEARCH FOUNDATION

PRIME MINISTER'S OFFICE SINGAPORE

Disconnect 3

Disconnect 2

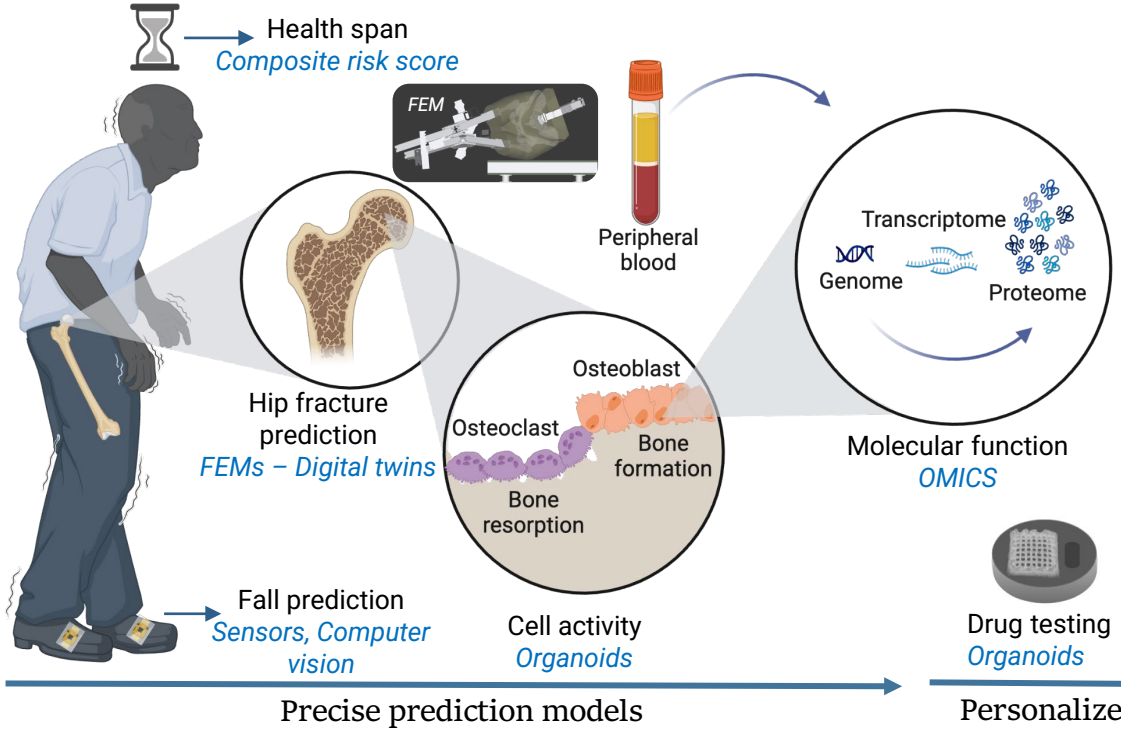
Predictions and Interventions for falls and fracture risks

CREATE
Campus for Research Excellence And Technological Enterprise

Future Health Technologies (FHT)

Early detection of health risks and interventions to optimize human health via **scalable digital solutions**

FHT1 2022-2026 → FHT2 2026-2030

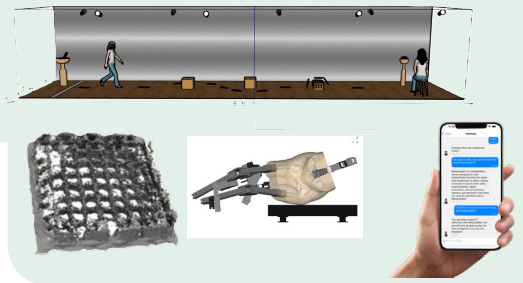


Potential Outcomes

Translating insights to drive further progress in clinic and community

SAFE TECH · ZurichMOVE · Health Promotion Board

Develop new tech for personalised screening and intervention strategies




Asst. Prof. Bryan Tan


Dr. Navrag Singh


PD Dr. Benedikt Helgason


Assoc. Prof. Angelique Chan


Prof. Stephen J. Furgeson


Prof. Torsten Hoefler


Dr. Anitha Praveen


Prof. May Oo Lwin


Prof. Rahul Malhotra


Dr. Jacqueline Mair


Prof. Ralph Müller


Dr. Chris Steffi

(SEC) SINGAPORE-ETH CENTRE · ETH zürich · National Healthcare Group · BOND UNIVERSITY · DukeNUS Medical School · NUHS · NUS National University of Singapore · NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Disconnect 3

Disconnect 2

Predictions and Interventions for falls and fracture risks

P1 **Sensor-based assessment of fall risk**

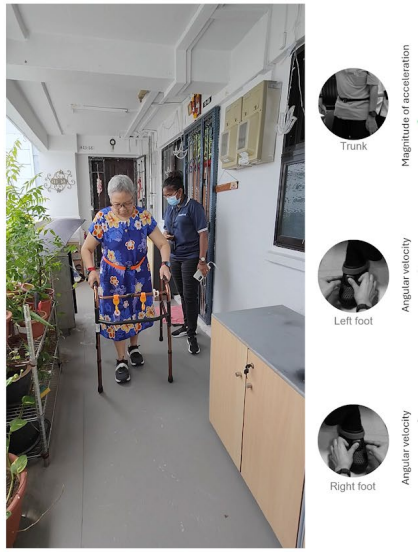
- Validated predictive model for assessing fall risk
- Utilizes minimal and comfortable wearables
- Suitable for home-based assessments
- Suitable for monitoring of recovery post interventions
- Large data collections in two cohorts (TARGET and PIONEER)

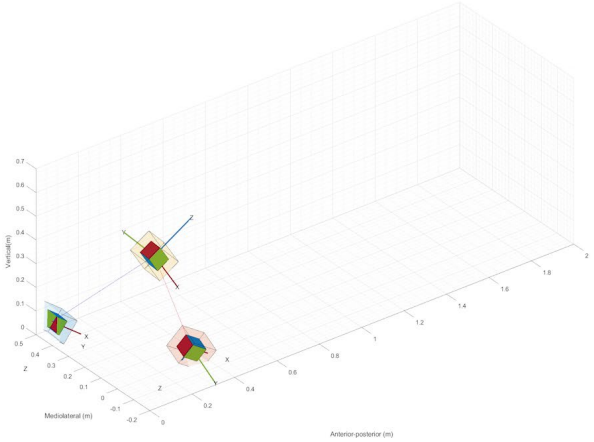
FHT1

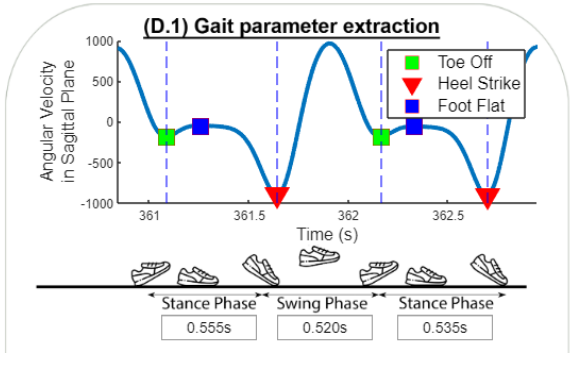
Identified specific gait markers for future fall predictions

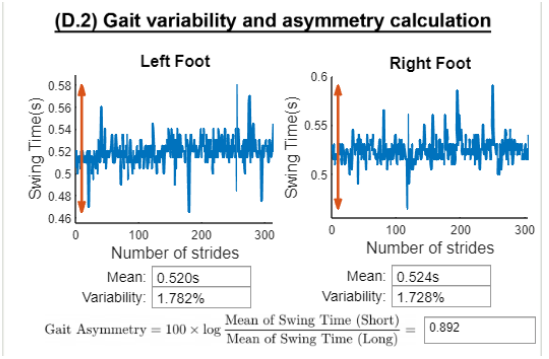
FHT2

- Community Implementation
- Validating computer vision for falls prediction
- Investigating perturbation responses









(SEC) SINGAPORE-ETH CENTRE · ETH zürich · National Healthcare Group · Bond University · DukeNUS Medical School · NUHS · NUS National University of Singapore · Nanyang Technological University Singapore

Disconnect 3

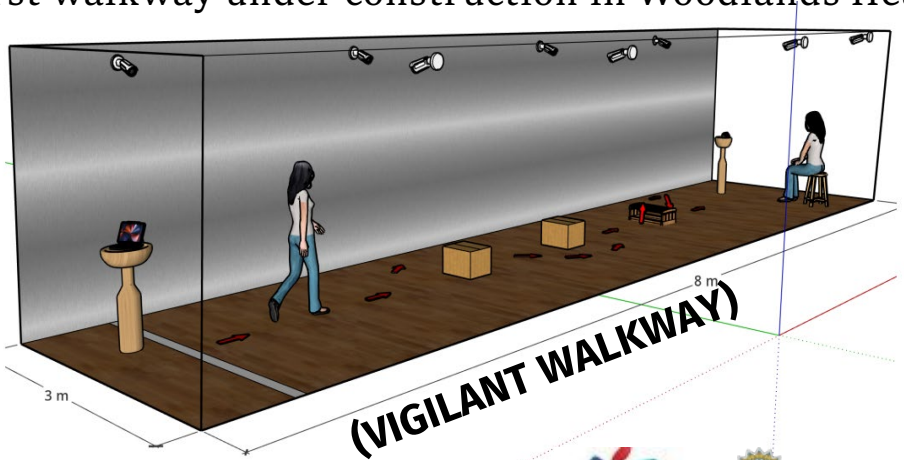
Disconnect 2

Predictions and Interventions for falls and fracture risks

P1 **Computer vision-based validation of fall risk**

- Augments sensor-based fall risk data at hospital settings (VITAL COHORT)
- Suitable for measuring joint kinematics, movement fluidity, and range of motion
- Suitable for identifying specific factors (e.g., hip, knee, ankle dysfunction) contributing to fall risk
- Can be incorporated to obstacle walkways (VIGILANT) and perturbation training

First walkway under construction in Woodlands Health



(SEC) SINGAPORE-ETH CENTRE | ETH zürich | National Healthcare Group | BOND UNIVERSITY | DukeNUS Medical School | NUHS | NUS National University of Singapore | NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Disconnect 3

Disconnect 2

Predictions and Interventions for falls and fracture risks

P2 **AI/FE modelling-based fracture risk prediction**

- Biofidelic Finite Element Models providing a realistic representation of the pelvis and surrounding soft tissues
- Tailored dynamics to simulate natural fall conditions
- Novel markers to characterize biomechanical risk of hip fracture
- AI models to rapidly predict FEM results for integration into clinical practice

FHT1

Identified clinically relevant risk of fracture given an occurrence of a fall.

FHT2

- Develop AI models for predicting femoral strength (S) and fracture risk given a fall (P_{Fx})
- Validating and predicting treatment effects on S and P_{Fx}

(SEC) SINGAPORE-ETH CENTRE · ETH zürich · National Healthcare Group · BOND UNIVERSITY · DukeNUS Medical School · NUHS · NUS National University of Singapore · NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Disconnect 3

Disconnect 2

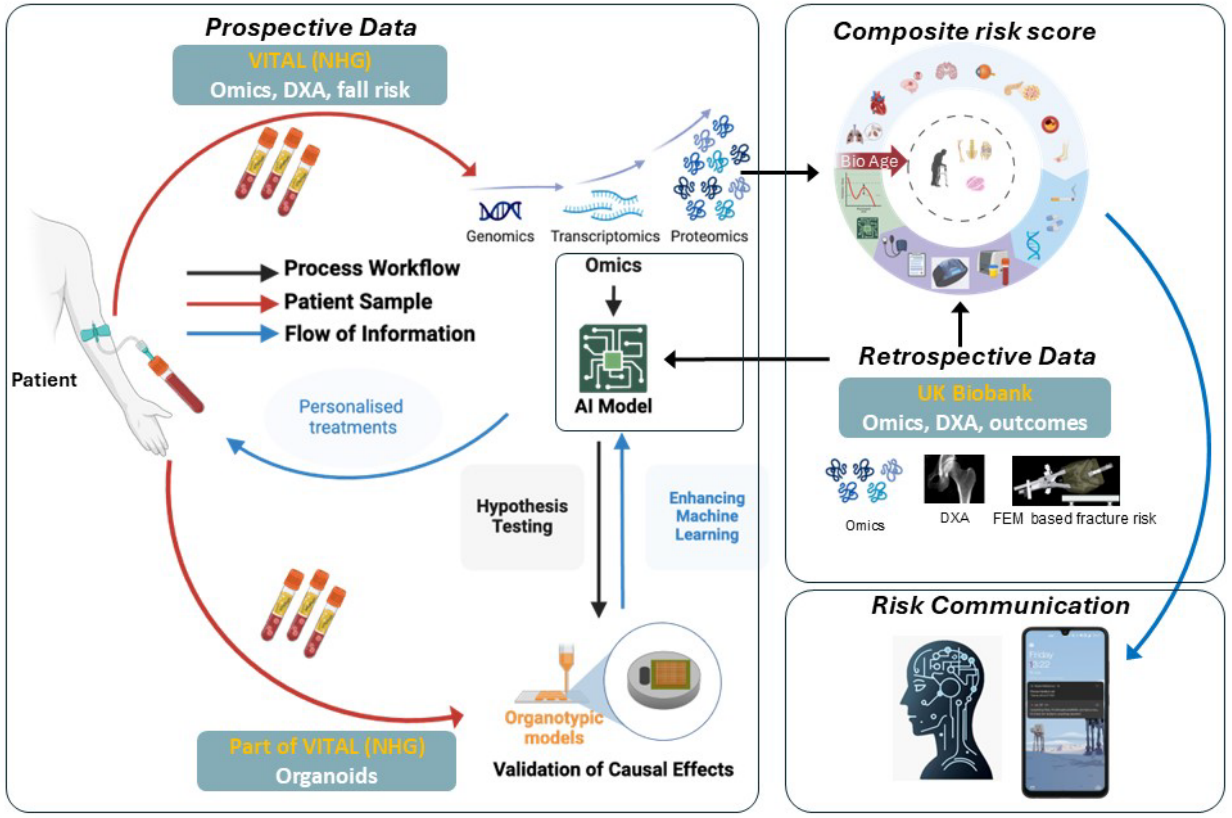
Predictions and Interventions for falls and fracture risks

P3 **Composite risk scores and communication**

Combination of all collected biomarkers (physical/biochemical) and clinical indicators to develop a composite risk score enabling personalized intervention strategies.

FHT2

- Incorporate fall risk (P1), fracture risk (P2) and rate of aging (frailty or omics based aging prediction from P3) to a composite risk score
- Enhance precision of the composite risk scores with large databases
- Use composite risk score AI models for hypothesis generation to identify treatment targets



(SEC) SINGAPORE-ETH CENTRE | ETH zürich | National Healthcare Group | BOND UNIVERSITY | DukeNUS Medical School | NUHS | NUS National University of Singapore | NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Disconnect 3

Disconnect 2

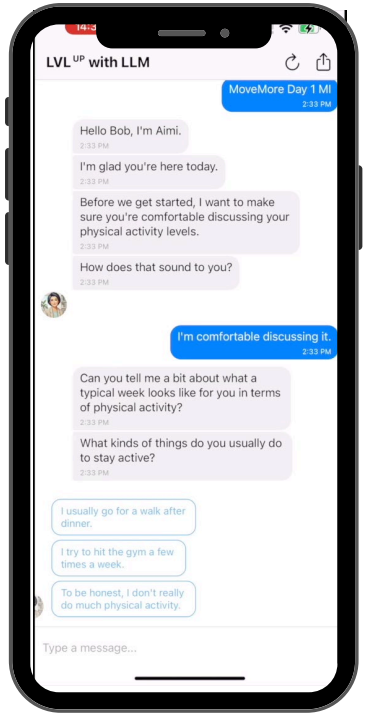
Predictions and Interventions for falls and fracture risks

P4 SAFE-TECH GO (Multi-component Falls Prevention Program)

- Development of an implementation toolkit and complementary Precision Digital Therapeutic (PDTx)
- Train clinic and community providers (i.e., Active Ageing Centres, Peoples' Association and Community Centres) to implement SAFE-TECH GO in the community
- Process and outcome evaluation of implementation (fidelity, adherence) and effectiveness (physical function, incident falls/fractures) → Proving scalability
- AI-powered monitoring and motivational support to promote adherence and behavioral change

SAFE TECH

Digitally delivered



FHT1

Developed a scalable fall risk intervention program with ongoing validation both at community and clinics

FHT2

- SAFE-TECH GO with PDTx app
- Digital coach, making support accessible and scalable
- Enhanced risk communication and increased adherence
- Mixed methods approach
- Outcome evaluation

(SEC) SINGAPORE-ETH CENTRE · ETH zürich · National Healthcare Group · BOND UNIVERSITY · DukeNUS Medical School · NUHS · NUS National University of Singapore · NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

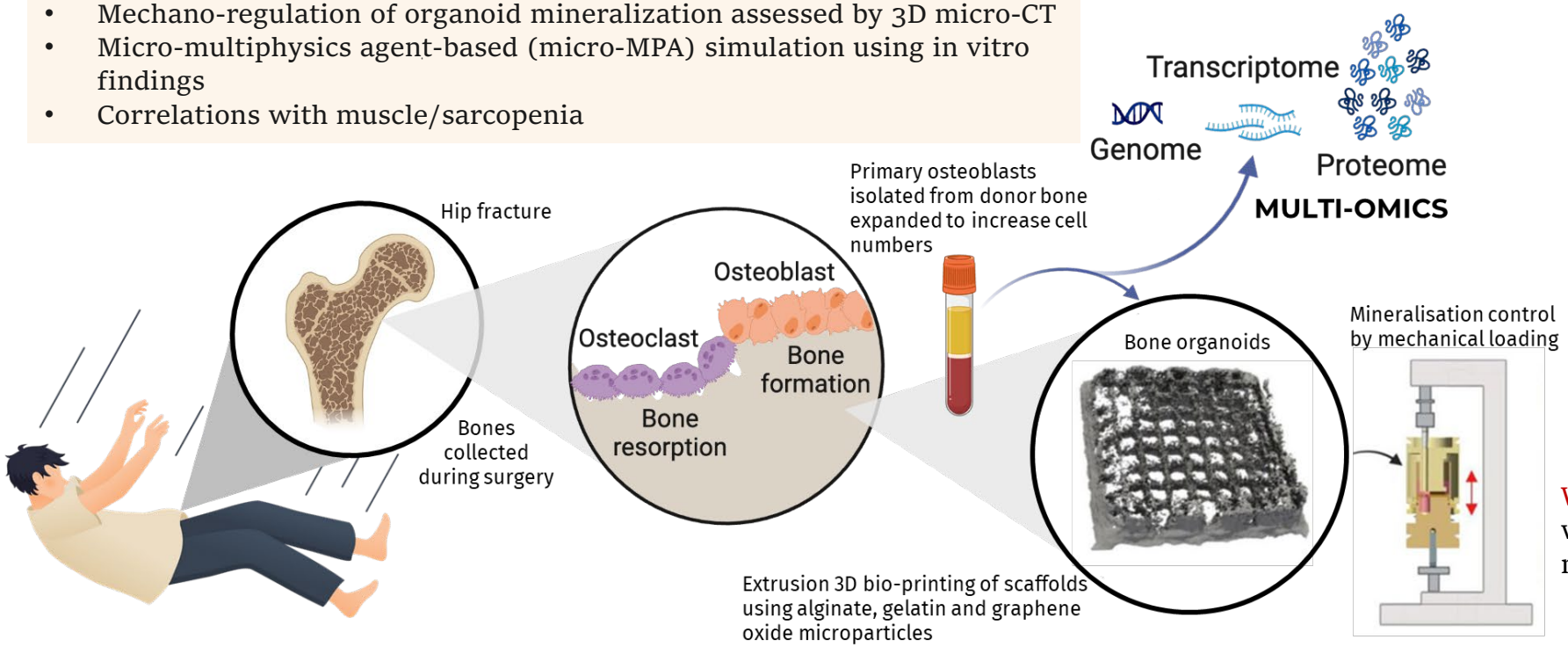
Disconnect 3

Disconnect 2

Predictions and Interventions for falls and fracture risks

P5 **Bone Organoids**

- 3D-bioprinted patient-specific organotypic bone models
- Flexibility to model healthy and pathogenic conditions
- Mechano-regulation of organoid mineralization assessed by 3D micro-CT
- Micro-multiphysics agent-based (micro-MPA) simulation using in vitro findings
- Correlations with muscle/sarcopenia



Woodlands Health Wet Lab Facility with 3D bio-printer, µCT scanner and mechanical simulation units

(SEC) SINGAPORE-ETH CENTRE | ETH zürich | National Healthcare Group | BOND UNIVERSITY | DukeNUS Medical School | NUHS | NUS National University of Singapore | NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Disconnect 3

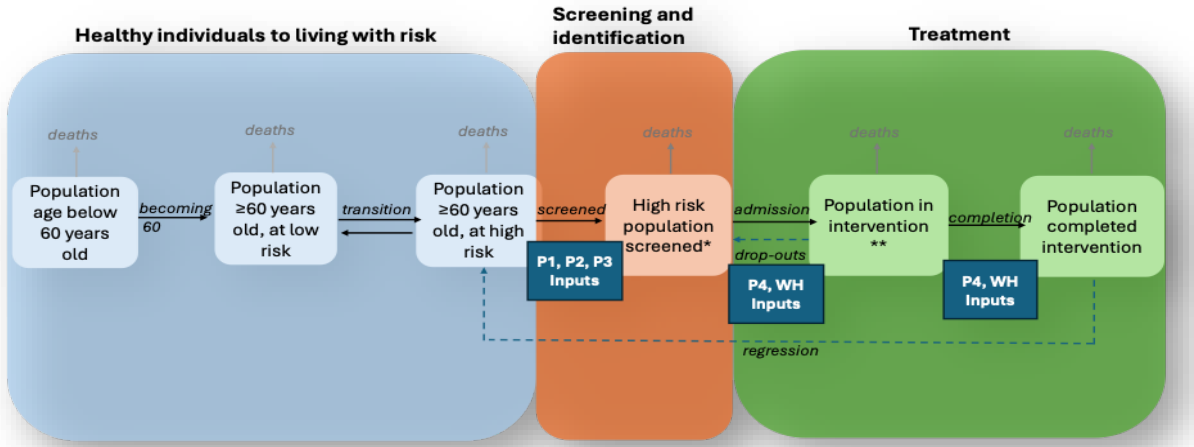
Disconnect 2

Predictions and Interventions for falls and fracture risks

P6

Continuous Value Assessment (Systems Dynamics Modelling)

- Coherent ongoing evaluation of a complex intervention from conceptualization through implementation and revision.
- Simulation modelling helps evaluate the impact of falls and fracture prevention/management initiatives at a population level by analyzing complex system interactions.



*models for falls screening and fracture screening will be built separately to account for falls/fracture screening
** interventions after screening results will be built based on a respective screener used

FHT1

- Development of a clinical decision tool
- Health care economics on specific use cases

FHT2

- Develop a quantitative SD simulation model of falls and fracture prevention/ management
- Applying simulation model to estimate health and economic impacts of proposed FHT2 strategies
- Provide information to decision-makers on prospective design and planning by understanding various potential scenarios and relative trends
- Recommend strategies as a form of policy recommendation

(SEC) SINGAPORE-ETH CENTRE · ETH zürich · National Healthcare Group · BOND UNIVERSITY · DukeNUS Medical School · NUHS · NUS National University of Singapore · NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Disconnects in Musculoskeletal Healthcare

1

Biomedical vs Biopsychosocial

Emphasis of biomedical factors and *neglect of psychosocial determinants* of health in clinical assessments and treatment

2

Reactive vs Preventative Care

Understating preventative interventions that are proven to delay disease progression, while prioritising short-term fixes after patients present with symptomatic MSK diseases or injury,

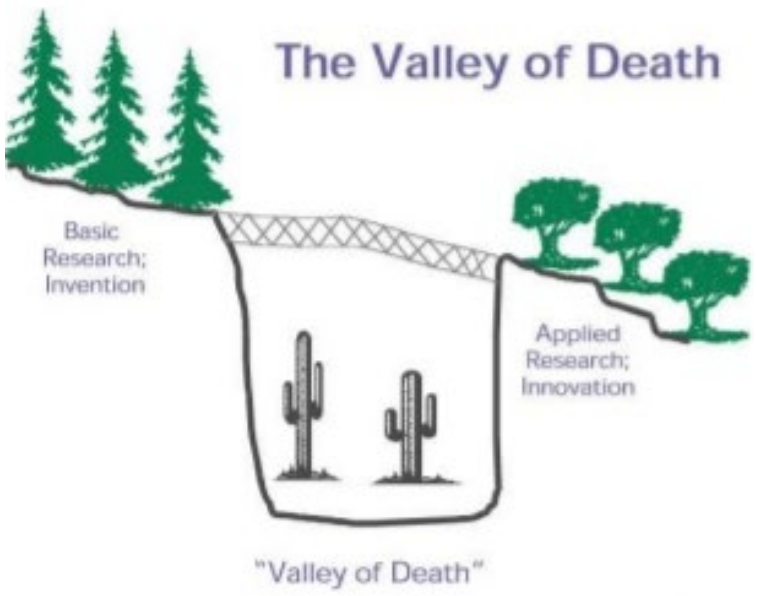
3

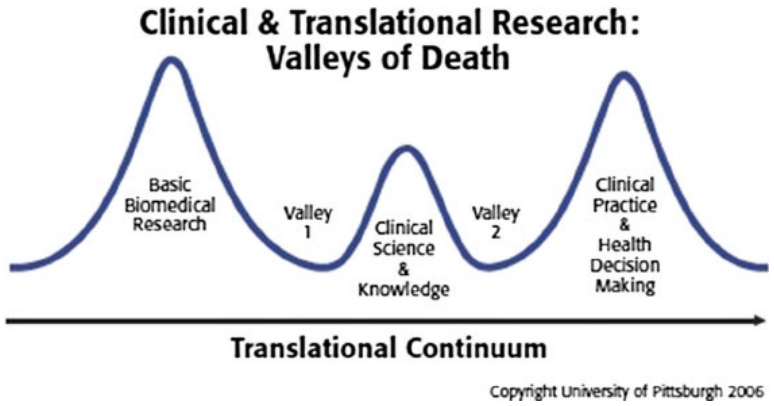
Research vs Practice vs Policy

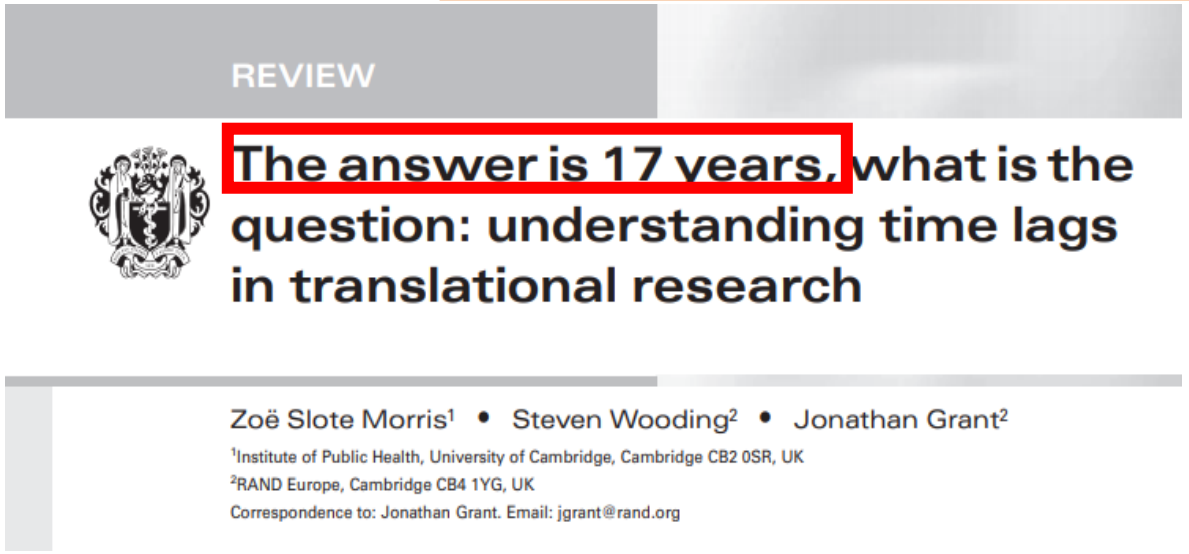
Lack of translation from research findings into clinical practice and policies that can promote system-level change

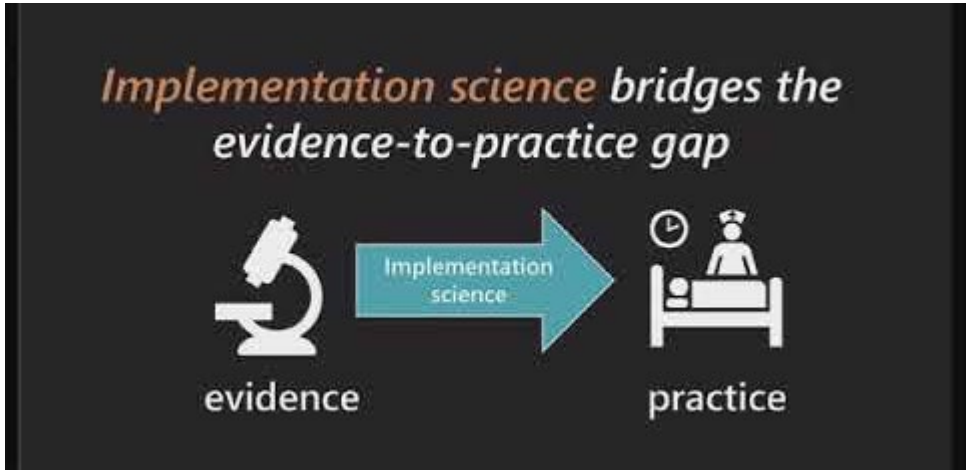
Disconnect 3

Avoiding the Valley of Death: Implementation Science









Disconnect 3

Avoiding the Valley of Death: Implementation Science

Journal of Evaluation in Clinical Practice
International Journal of Public Health Policy and Health Services Research

Journal of Evaluation in Clinical Practice ISSN 1365-2753

SYSTEMATIC REVIEW

Assessing appropriateness of osteoarthritis care using quality indicators: a systematic review

Martin Basedow MPH FCHSM FAIM[1] and Adrian Esterman BSc (hons)

>50% of patients receive suboptimal care

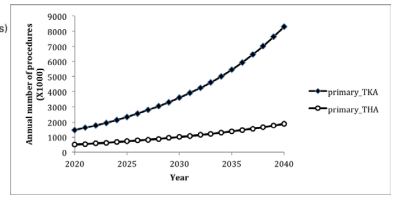
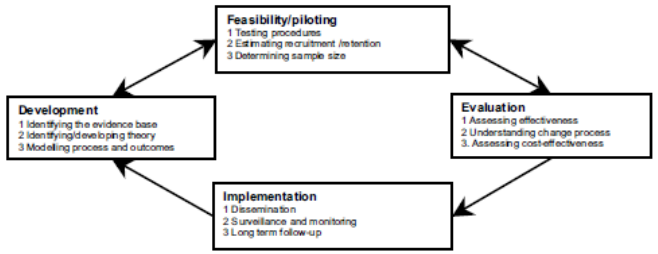


Figure 1 Key elements of the development and evaluation process



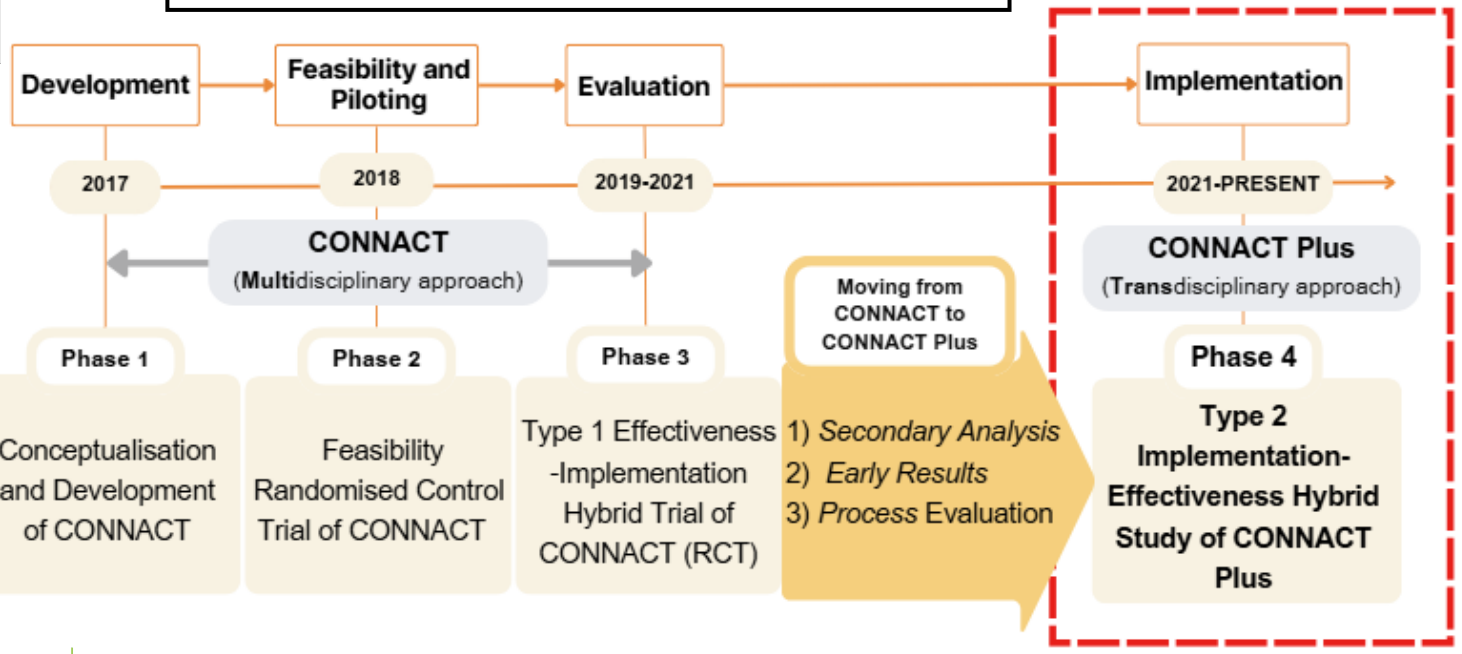
MRC Medical Research Council

Episodic → Chronic Care Model

Collaborative model of care between Orthopaedics and allied healthcare professionals

CONNACT
Transforming Musculoskeletal Care

Implementing personalized interventions for individuals with knee OA, including physiotherapy exercises and education



Asst. Prof. Bryan Tan

Dr. Michelle Jessica Pereira

Dr. Pua Yong Hao

Dr. Yang Su- Yin

National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

Active Health
Manage Osteoarthritis with Exercise
In collaboration with

St Luke's ELDERCARE

ntuc Health

National Healthcare Group POLYCLINICS

Disconnect 3

Avoiding the Valley of Death: Implementation Science

CONNACT
Transforming Musculoskeletal Care

Best Practice & Research Clinical Rheumatology 30 (2016) 503–535

Contents lists available at ScienceDirect

Best Practice & Research Clinical Rheumatology

journal homepage: www.elsevierhealth.com/berh

8

Osteoarthritis: Models for appropriate care across the disease continuum

RESEARCH ARTICLE Open Access

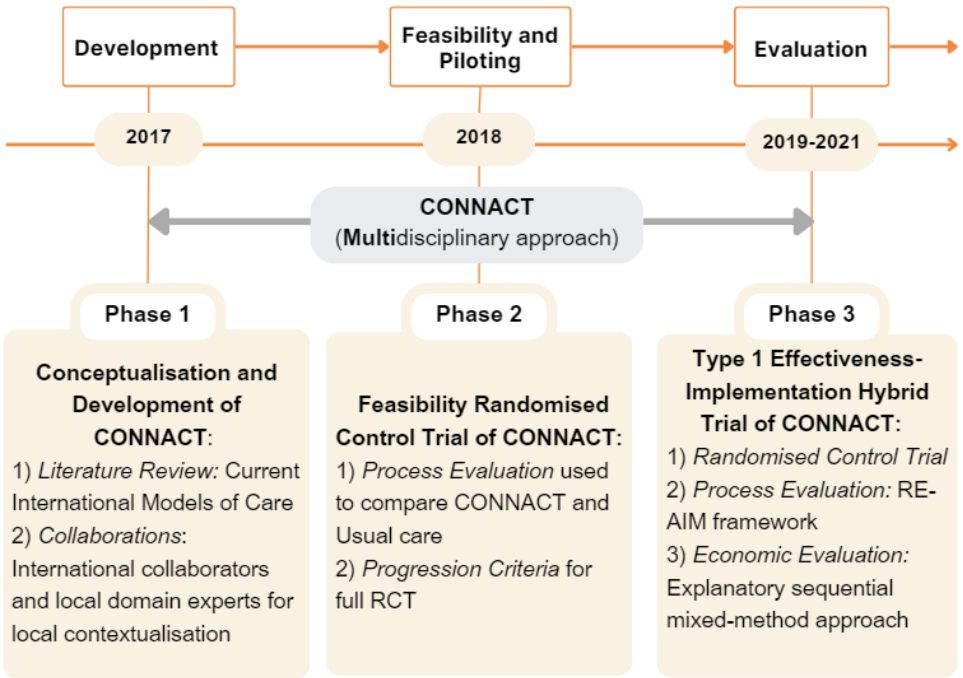
Collaborative model of care between Orthopaedics and allied healthcare professionals trial (CONNACT) – a feasibility study in patients with knee osteoarthritis using a mixed method approach

Bryan Yijia Tan[1,2*], Benjamin Tze Keong Ding[3], Michelle Jessica Pereira[4], Soren Thorgaard Skou[5,6], Julian Thumboo[7] and Josip Car[2]

STUDY PROTOCOL Open Access

Collaborative model of care between Orthopaedics and allied healthcare professionals in knee osteoarthritis (CONNACT): study protocol for an effectiveness-implementation hybrid randomized control trial

Bryan Yijia Tan[1,2*], Michelle Jessica Pereira[3], Su-Yin Yang[1,4], David J. Hunter[5], Soren Thorgaard Skou[6,7], Julian Thumboo[7] and Josip Car[4]



Osteoarthritis and Cartilage

Collaborative Model Of Care Between Orthopaedics And Allied Healthcare Professionals (Connact) For Knee Osteoarthritis: 12-Months Follow-Up Of An Effectiveness-Implementation Hybrid Trial

B. Tan [1] · M. Pereira [2] · S.-Y. Yang [1] · C. Lim [1] · C. Tan [1] · E. Woon [3] · Y. Pua [4] · J. Ng [5] · K. Lee [6] · A. Briggs [7] · D. Hunter [8] · S. Skou [9] · J. Thumboo [4] · J. Car [3] Show less

Osteoarthritis Chronic Care Program (OACCP), Australia

Better management of patients with osteoarthritis (BOA), Sweden

Good Life with osteoarthritis in Denmark (GLAD), Denmark

Amsterdam Osteoarthritis Cohort (AMSOA), Netherlands

Joint Implementation of Osteoarthritis guidelines in the West Midlands (JIGSAW), UK

MOA trial, the Joint Clinic, New Zealand

National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

St Luke's ELDERCARE

ntuc Health

National Healthcare Group POLYCLINICS

Disconnect 3

Avoiding the Valley of Death: Implementation Science

CONNACT
Transforming Musculoskeletal Care

1. Physiotherapy exercises

Flexibility (calf stretch, hamstring stretch)

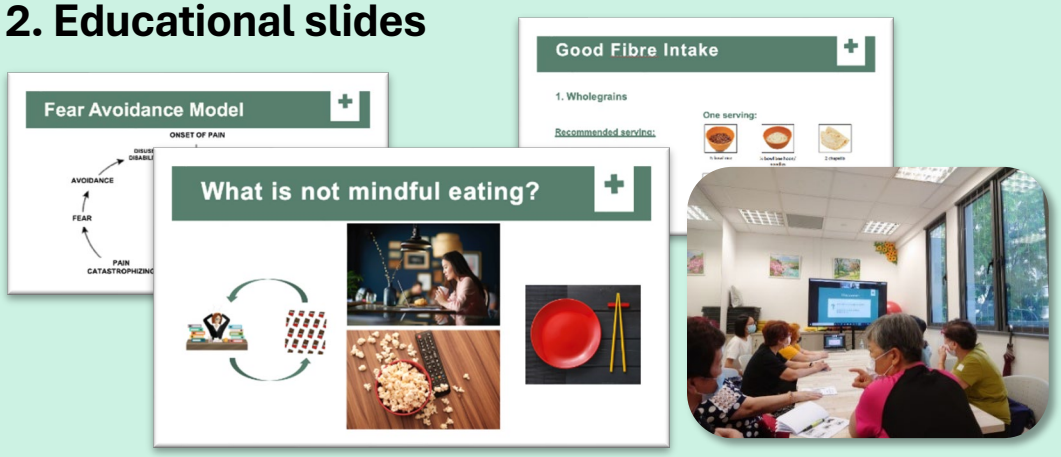
Strengthening (knee extension, flexion)

Functional Activities (sit-to-stand, step up step down)

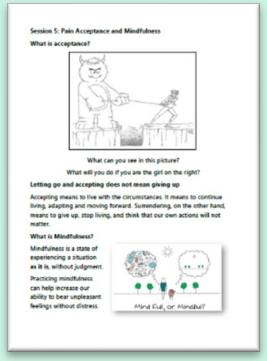
Balance (tandem balance)

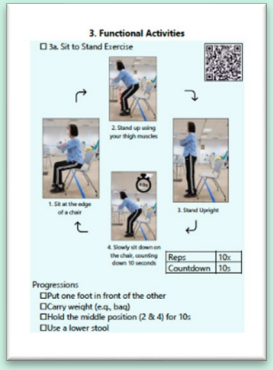
Aerobic

2. Educational slides

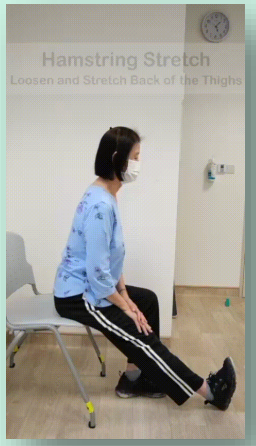


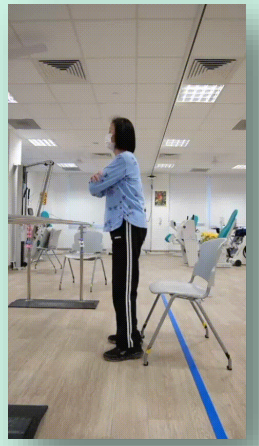
3. Participants handouts





4. Exercise videos





Disconnect 3

Avoiding the Valley of Death: Implementation Science

CONNACT
Transforming Musculoskeletal Care

Implementation → **Upstreaming**

2021-PRESENT → **2024 ONWARDS**

CONNACT Plus
(**Trans**disciplinary approach)

Phase 4

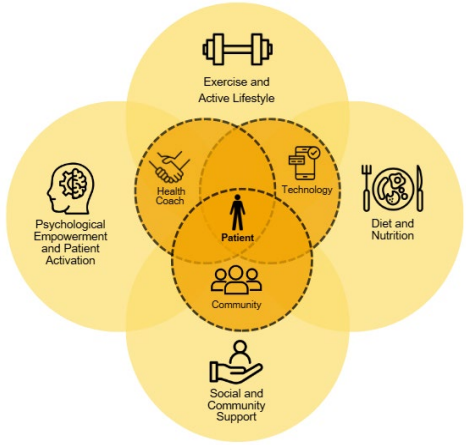
Type 2 Implementation-Effectiveness Hybrid Study of CONNACT Plus:
1) *Implementation:* Contextual Factors, Reach, Fidelity
2) *Effectiveness:* Clinical and Cost Effectiveness, Responders vs Non-responders

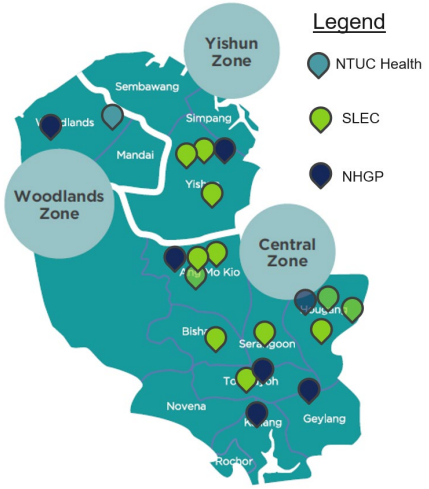
Phase 5

Scaling Up
1) Engaging other community partners (NTUC Health, Active Health)
2) Engaging primary care (GPs, Polyclinics)
3) Exploring other MSK conditions (eg. back pain)

Moving from CONNACT to CONNACT Plus

1) ***Secondary Analysis:*** Responders ⟶ higher PSY score and lower QOL and KOOS symptom scores
2) ***Early Results:*** Higher PSY scores ⟶ greater 12-month KOOS score improvement
3) ***Process* Evaluation:**
   a) **Transdisciplinary** approach for **sustainability and scalability**
   b) Intervention synergy
c) Beneficial group format





联合早报 100 百年如新
12周量身定制护理计划 助骨关节炎病患缓解疼痛

8world 新闻网
国立健保集团骨关节炎患者社区护理康复计划 九成病人情况改善

National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

Active Health
Manage Osteoarthritis with Exercise
In collaboration with
National Healthcare Group

St Luke's ELDERCARE

ntuc Health

National Healthcare Group
POLYCLINICS

Disconnect 3

Closing the gap between widely practiced TCM and lack of evidence

HarmoKNEE

Heat and Acupuncture RandoMised Control Trial to manage Osteoarthritis of the Knee (HARMOknee)

Evaluating the clinical effectiveness of TCM acupuncture with far-infrared heat therapy in addition to standard care, compared to standard care alone

$330k

MINISTRY OF HEALTH SINGAPORE

Traditional Chinese Medicine Research Grant (TCMRG)


Asst. Prof. Bryan Tan


Dr. Tan Tong Leng


Ms. Ng Hui Ping


Dr. Yang Su- Yin


Assoc. Prof. Kong Keng He


Dr. Tan Siang Ing

Disconnect between TCM practice and evidence

Review Article

Developing Traditional Chinese Medicine in the Era of Evidence-Based Medicine: Current Evidences and Challenges

Foon Yin Fung[1] and Yeh Ching Linn[2]

Evidence on acupuncture therapies is underused in clinical practice and health policy

Nenggui Xu and colleagues call for more effective evidence dissemination of and research into promising acupuncture therapies

Key messages

- Despite expanding TCM usage, lack of robust evidence is hindering acceptance of TCM into mainstream healthcare
- Multistakeholder effort to generate acupuncture evidence and support its implementation will enable a more evidence-based approach to practice and research

ACE agency for care effectiveness

Technology Guidance

Acupuncture

for adults with low back pain and neck pain

Technology Guidance from the MOH Medical Technology Advisory Committee

National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

Tan Tock Seng Hospital

Chung Hwa Medical Institution 中华医院 Singapore

Disconnect 3

Closing the gap between widely practiced TCM and lack of evidence

HARMOknee

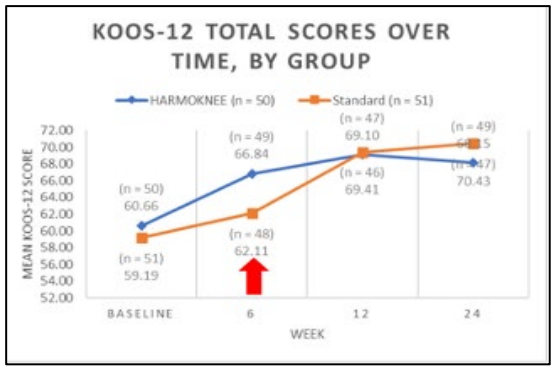
- Randomised controlled study
- Acupuncture and heat therapy as an adjunct to standard care

Far-infrared heat therapy + Acupuncture + Standard care

HARMOknee group

Standard care

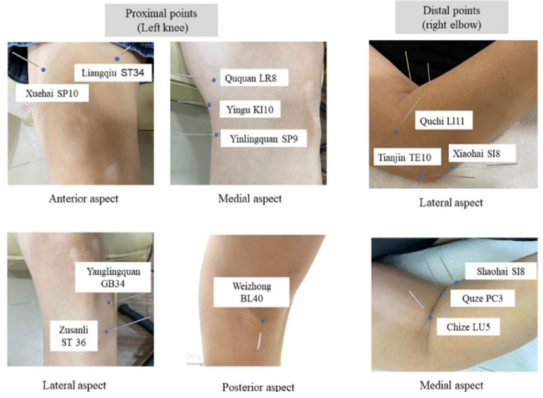
Control group



Key messages

Compared with control:

- HARMOknee group had short term effectiveness (pain, function), no difference long term
- Adjunctive treatment for pain + lifestyle interventions
- Identified TCM syndrome most effective to harmoknee intervention – kidney yang deficiency



National Healthcare Group
Adding years of healthy life

Woodlands Health
National Healthcare Group

Tan Tock Seng Hospital

Chung Hwa Medical Institution 中华医院 Singapore

Disconnects in Musculoskeletal Healthcare

1

Biomedical vs Biopsychosocial

Emphasis of biomedical factors and *neglect of psychosocial determinants* of health in clinical assessments and treatment

2

Reactive vs Preventative Care

Understating preventative interventions that are proven to delay disease progression, while prioritising short-term fixes after patients present with symptomatic MSK diseases or injury,

3

Research vs Practice vs Policy

Lack of translation from research findings into clinical practice and policies that can promote system-level change


Thank you!