



# Infering activity and behavior from mobile and environmental sensors

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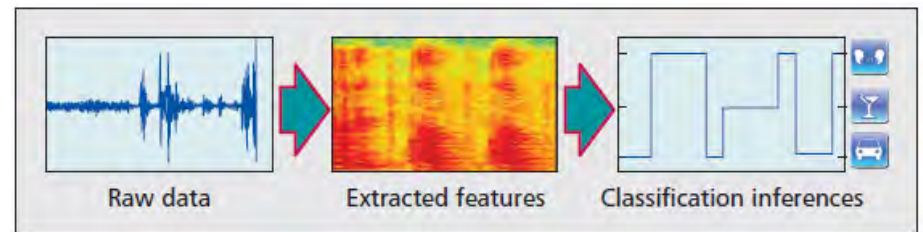
# Ubiquitous Sensors

User data

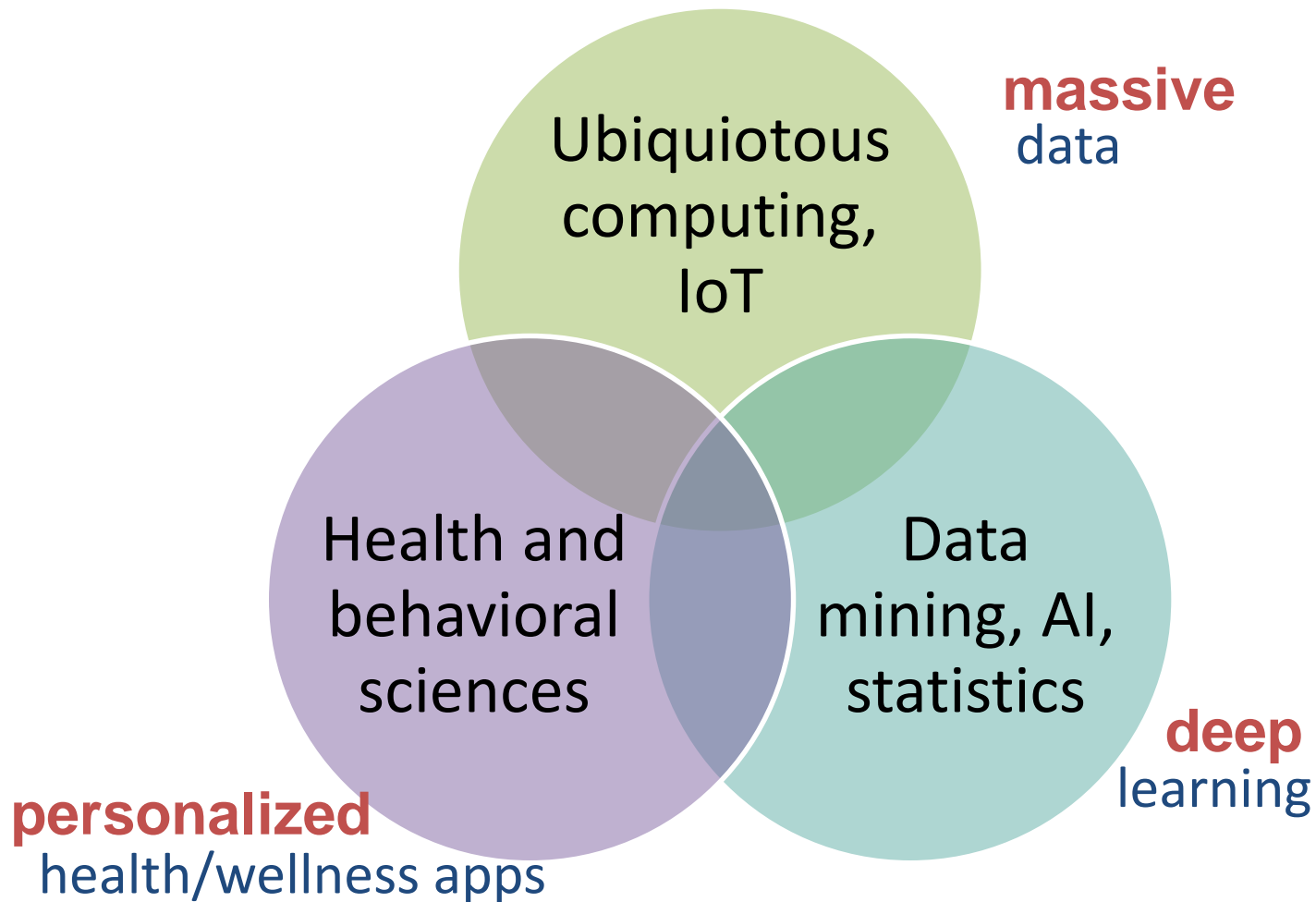


+  
Software  
sensors

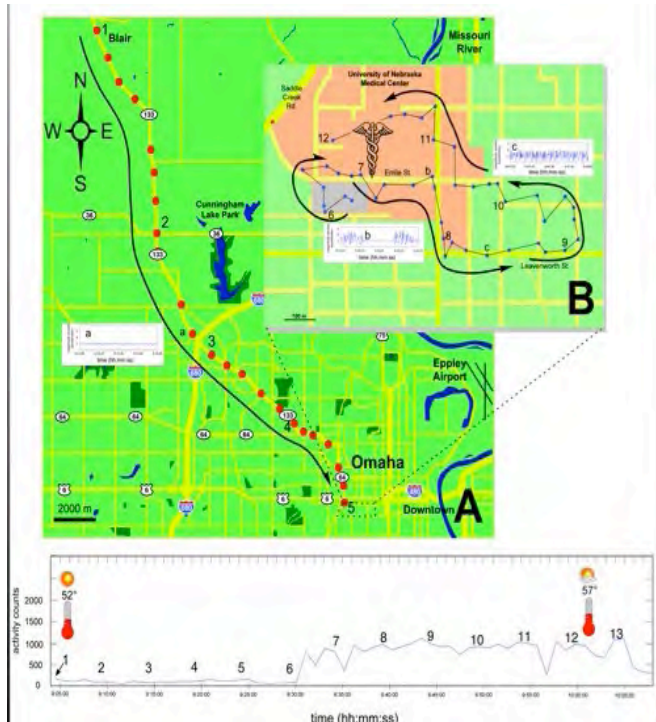
Activity/behavior recognition



# Activity/behavior recognition

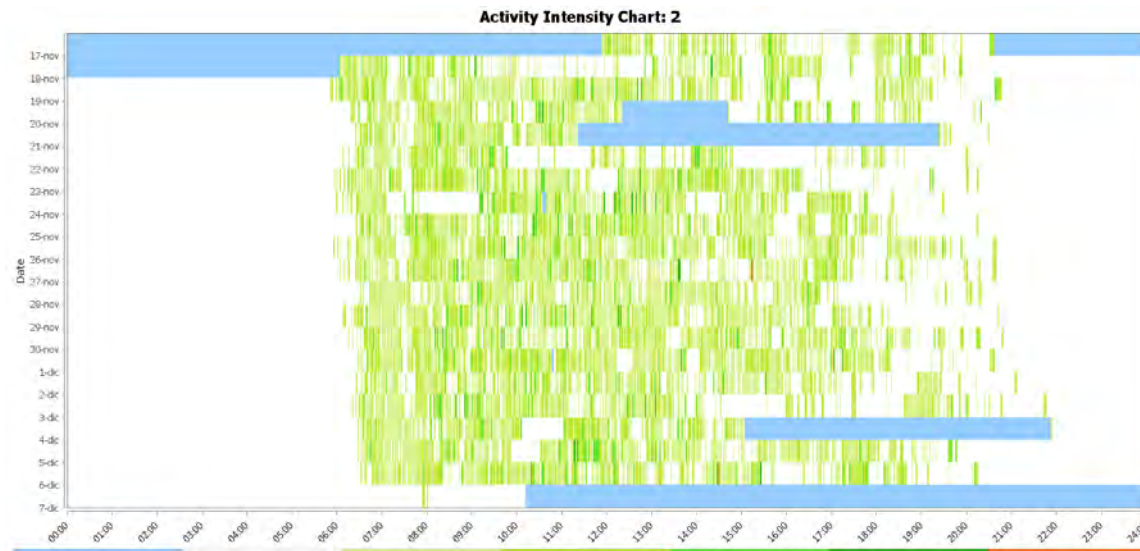


# Activities/behaviors relevant to health



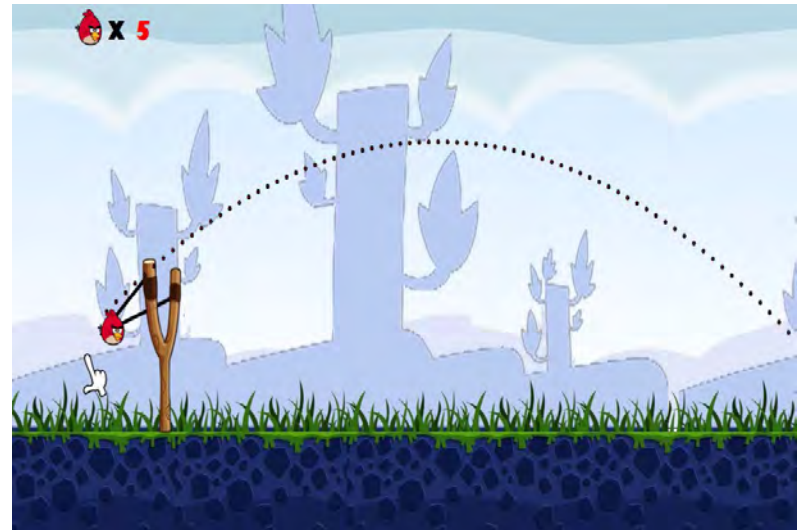
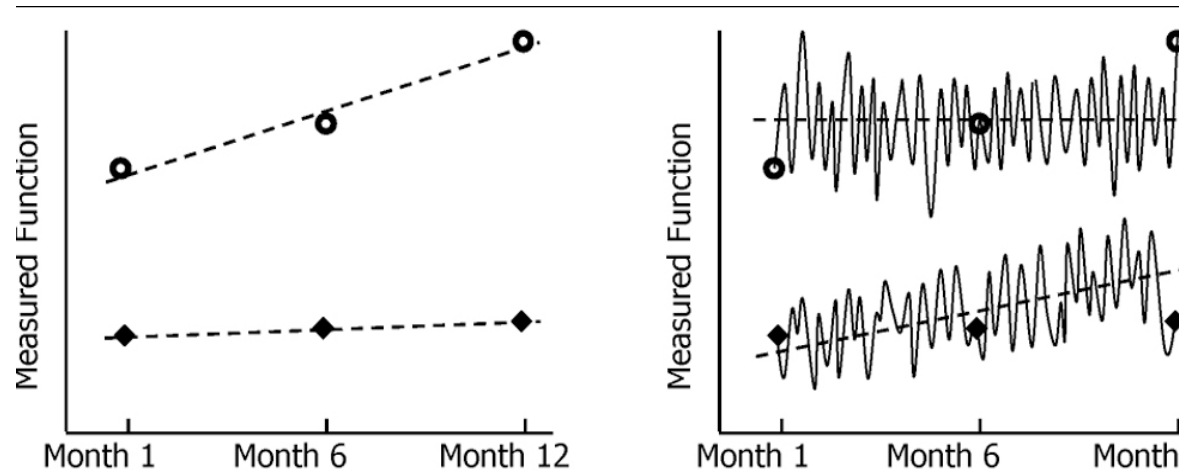
[Castro 2012]

[Bonasera & Schenk, 2011]



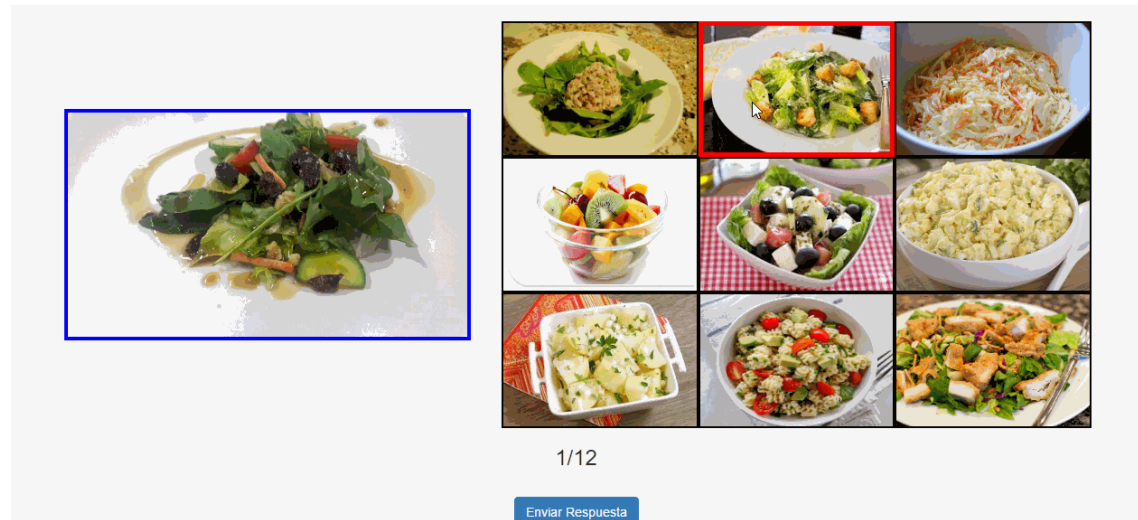


# Ambient videogames to estimate muscle strength and fatigue



[Pervasive Healthcare, 2012]

# Artificial + Human Intelligence

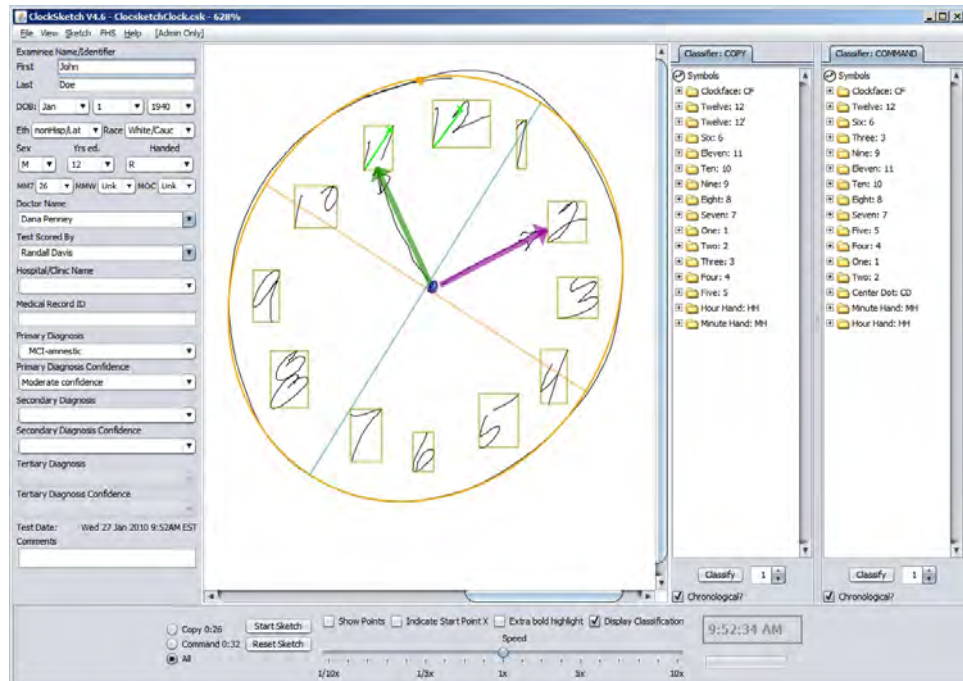
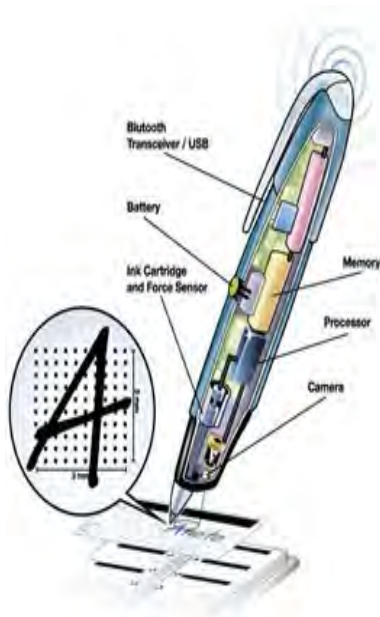


**TABLE 1.** Comparison of latency (LAT), cognitive load (CL), and accuracy (ACC) for crowdsourced approaches to assessing the nutritional content of meals.

Approach	Individual			Crowdsourced		
	LAT (s)	CL (%)	ACC (%)	ACC, n = 5 (%)	ACC, n = 10 (%)	ACC, n = 15 (%)
A1	10.60	50.40	28.81	27.63	24.37	22.22
A2	18.49	40.11	34.20	38.89	44.48	57.78
A3	7.04	<b>32.30</b>	—	—	—	—
A4	<b>5.61</b>	38.72	21.51	13.04	13.78	13.33
A5	28.02	42.39	<b>80.15</b>	<b>88.22</b>	<b>88.30</b>	<b>88.89</b>
A6	13.74	33.89	58.66	75.74	85.63	<b>88.89</b>

*n* = number of individual answers taken per image. Numbers in bold represent the best approach per condition.

# Digital clock test for dementia



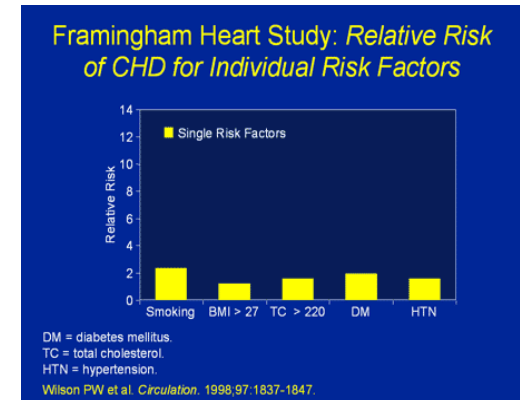
[Davis, 2013]

# The evolution of epidemiology

- Cholera (s. XIX)



- Framingham study (s. XX)



- Mobile monitoring (s. XXI)



# Precision Medicine Initiative



## GENOMICS

Our genes can suggest what diseases we *might* be predisposed to, but it's an incomplete picture of human health.



## PHENOTYPE

A snapshot of the current state of health that can be used to prevent, diagnose and treat disease or improve health.



## LIFESTYLE/ENVIRONMENT

External factors like diet, exercise, medications, microbiota and even where we live influence our metabolic state.

- One million individuals
- Genetic information, clinical data and information about behaviors (physical activity, sleep, food intake, etc.)

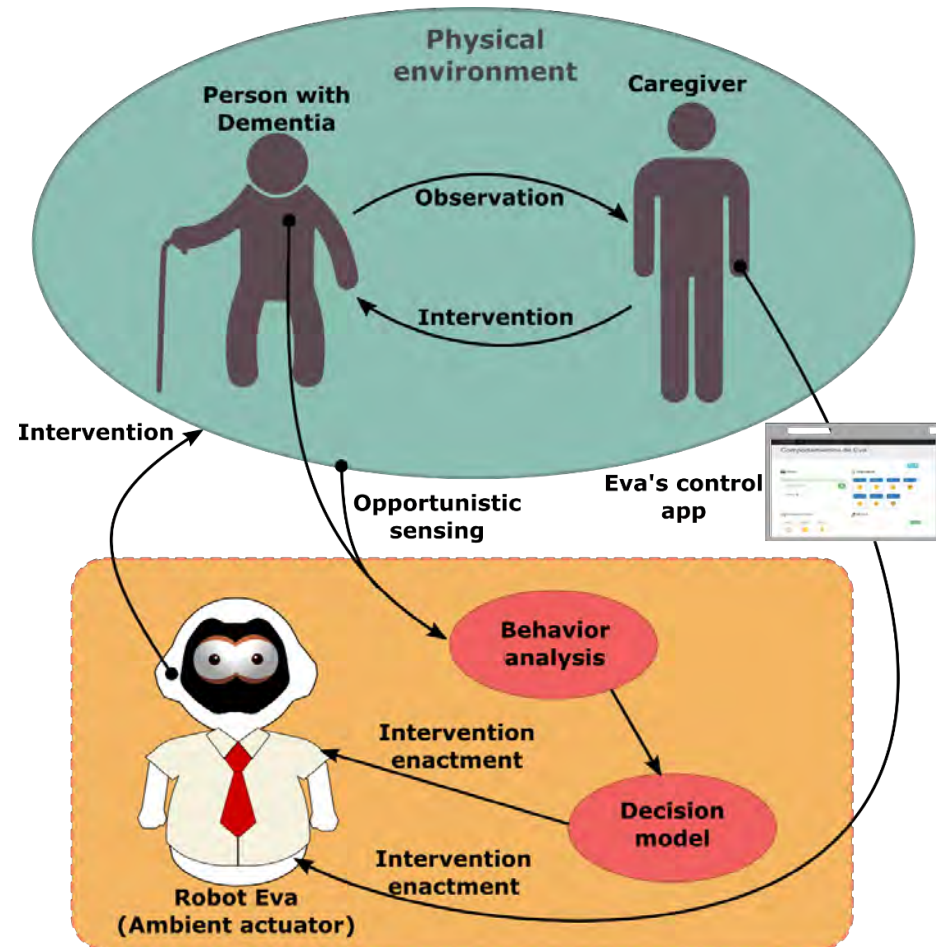
# Other current studies incorporating mobile sensing

- Framingham Health Study
  - Physical activity/ sleep
- Health eHearth study UCSF
  - 196,000 participants
  - 80-90% precision predicting hypertension and diabetes



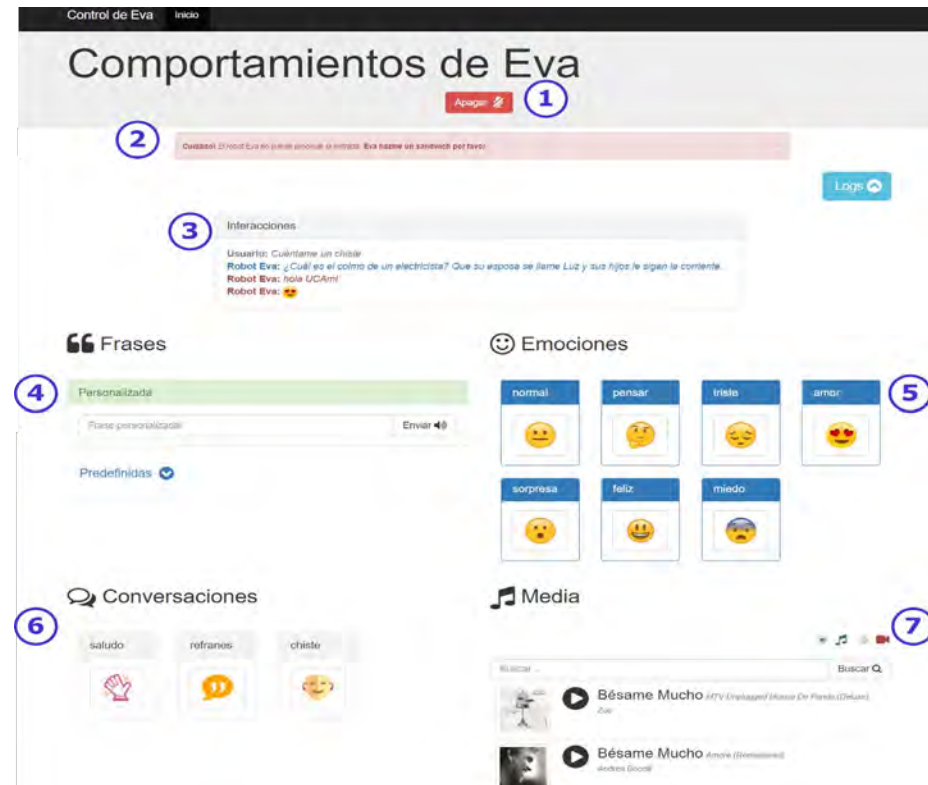
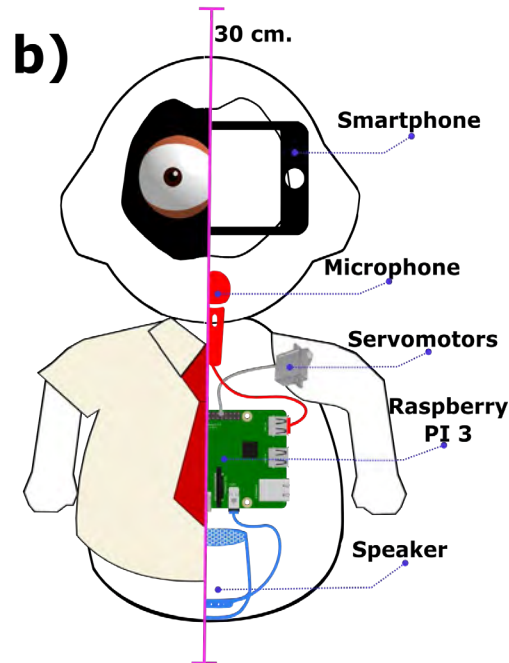
# Ambient-assisted Interventions (AaIS)

- To enact or recommend interventions to opportunistically address a BPSD
- Tailored to the progressive evolution of elders' needs
- Based on the caregivers' perspective



# Intervention

## Eva: A conversational robot



Control de Eva Inicio

### Comportamientos de Eva

Apagar 1

2 Cambiar el robot Eva en pantalla mostrando su nombre. Eva hace un sonido por favor.

3 Interacciones

Usuario: Cuéntame un chiste  
Robot Eva: ¿Cuál es el color de un electricista? Que su esposa se llame Luz y sus hijos le sigan la corriente.  
Robot Eva: hola UCAM!  
Robot Eva: 😊

4 Frases

Personalizada

Frases personalizadas: Enviar

Predefinidas

5 Emociones

normal pensar triste amor

sorpresa feliz miedo

6 Conversaciones

saludo refranos chiste

7 Media

Buscar Q

Bésame Mucho JRTV (Desaparece) Mascar De Plástico (DJHunt)

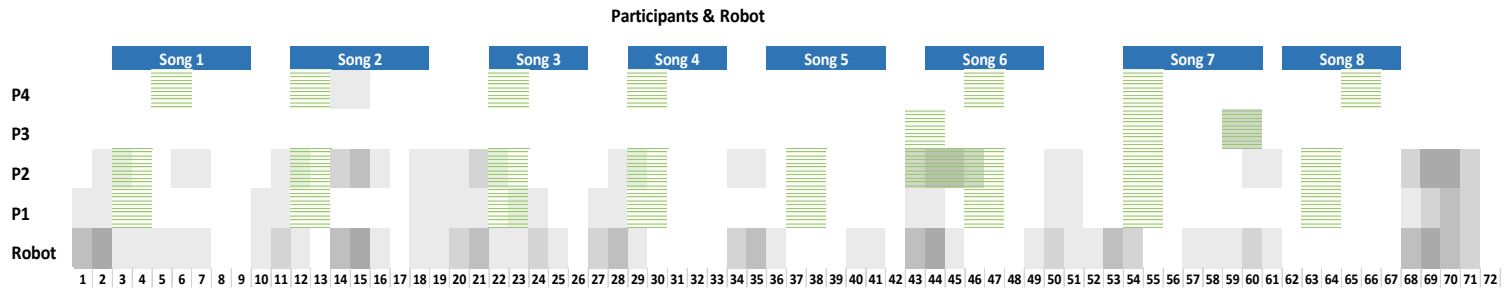
Bésame Mucho Amora (Remastered) Andres Good

# Adoption study

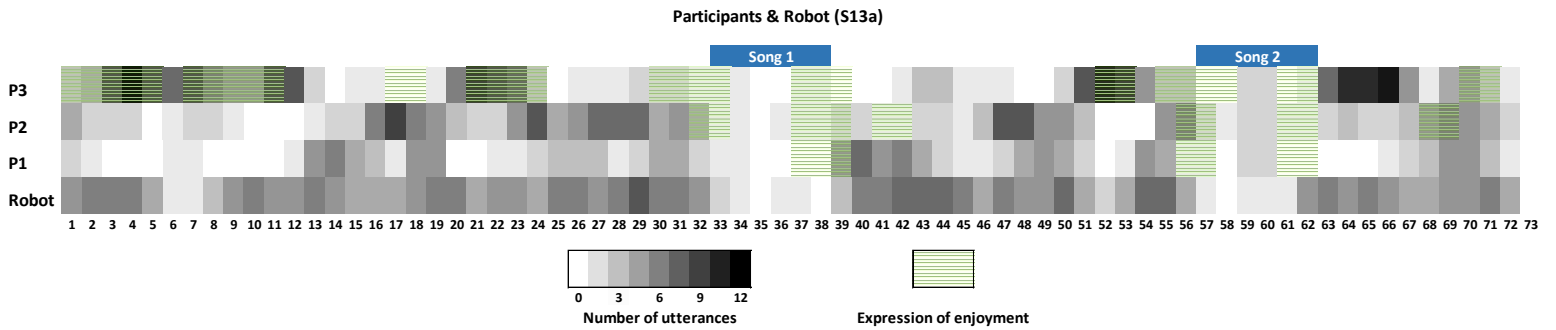
- 16 weeks, 12 participants (age 80.2; MMSE 14.1)
- Single subject research design; Wizard of Oz
- Conversational strategies for interacting with individuals with dementia
  - **Phase 1:** Small-talk strategies (i.e. Speak clearly and slowly; Allow plenty of time to respond; Use praise, motivational phrases)
  - **Phase 2:** Strategies for sustained conversations (i.e. Obtain information of interest and use it; Use humor to lighten the mood).

# Interaction heat map

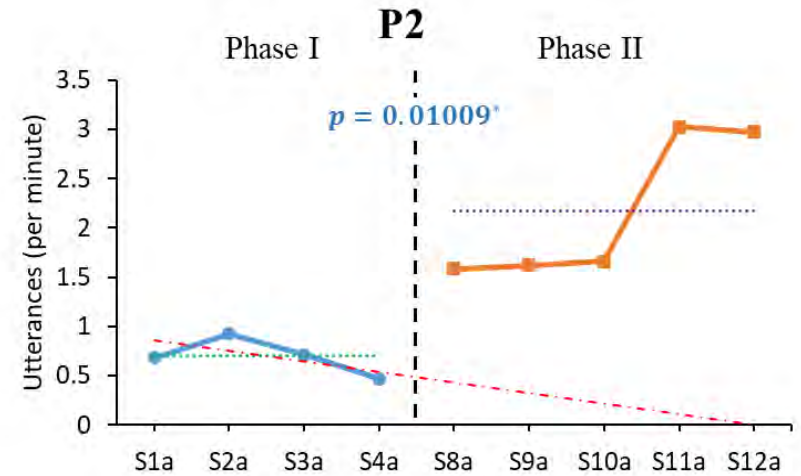
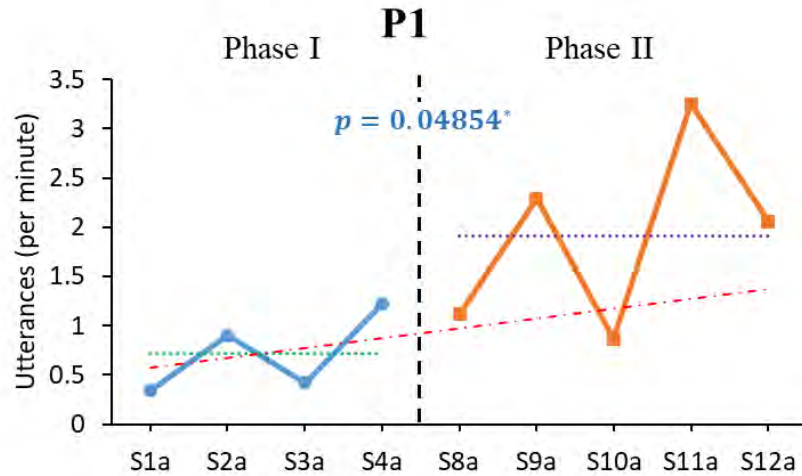
Session 1



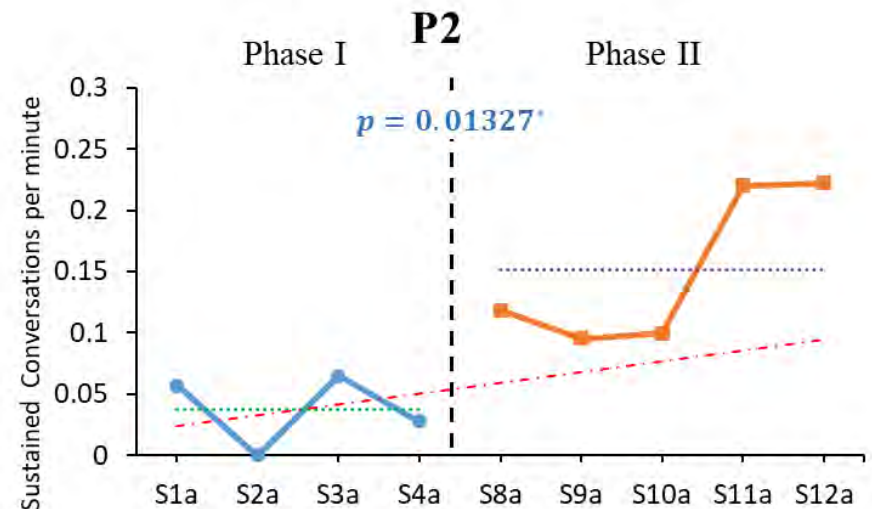
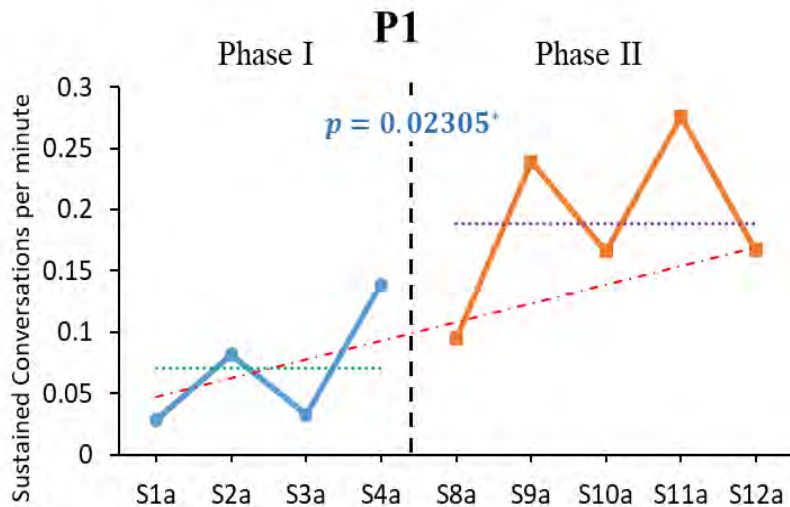
Session 13



# Increase in communication per minute



# Sustained conversations

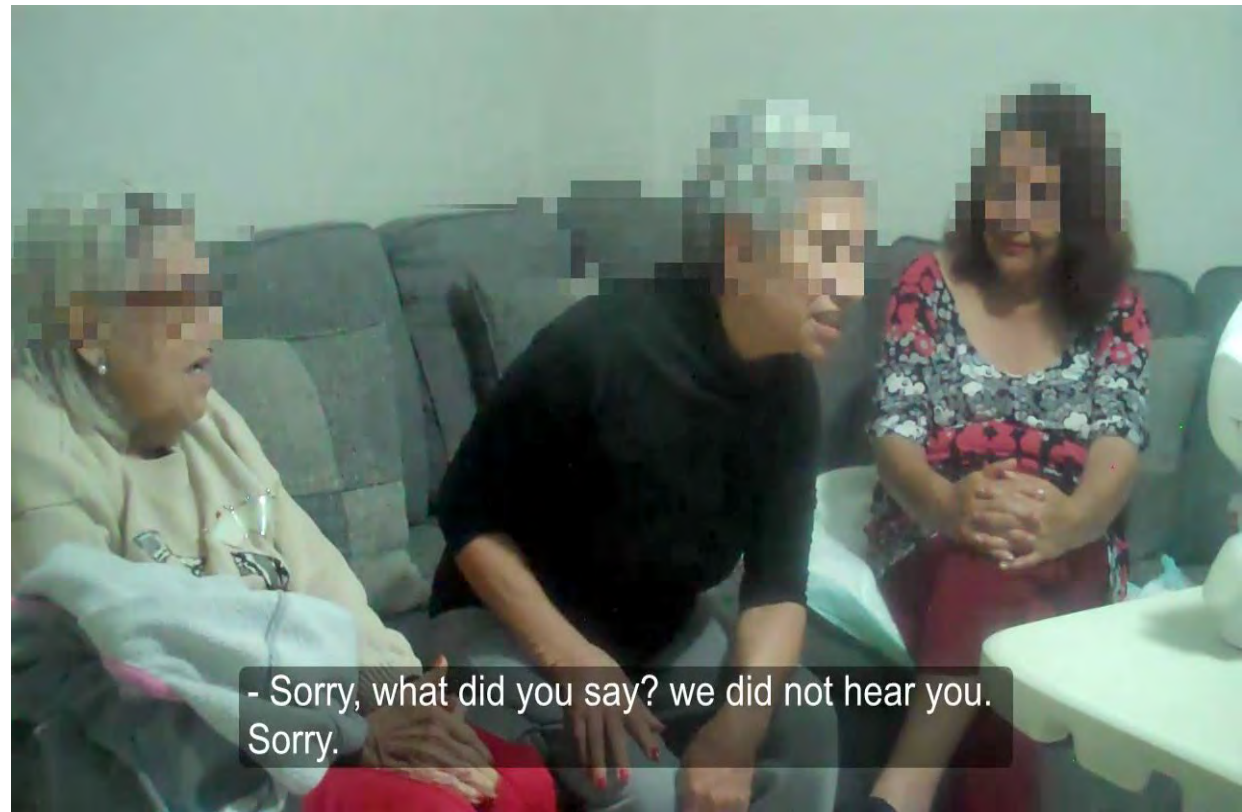


# Responding to requests from Eva



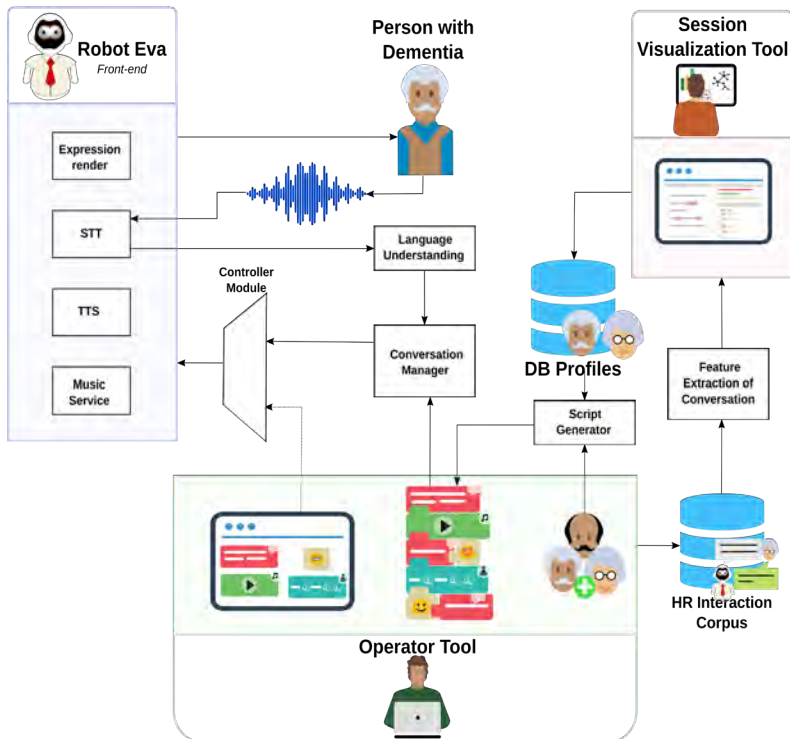


# Engagement



- Sorry, what did you say? we did not hear you.  
Sorry.

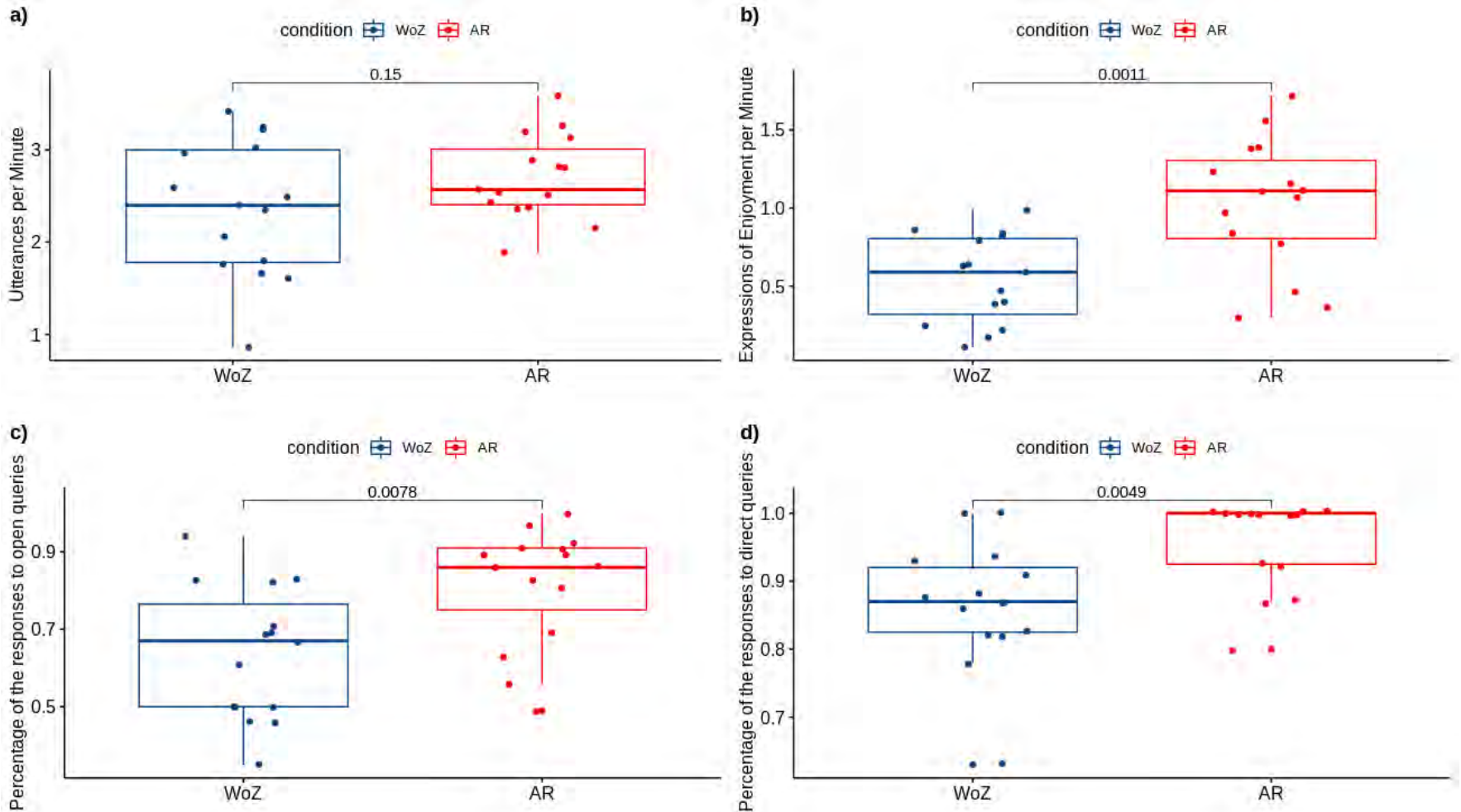
# Autonomous behavior



The screenshot shows the Session Visualization Tool interface, displaying a conversation log and a participant profile. The interface is divided into three main sections:

- Conversation (a):** A list of utterances from a session on 5/30/2018. The log shows a conversation between a user and Robot Eva. The user asks for recommendations for food in Guadalajara, and Robot Eva provides several suggestions, including 'picadillo del Norte' and 'carne asada'. The user responds with '¡Marta bonita! Marta bonita! María del alma que ni ando roncó'.
- Information (b):** A summary of the conversation, including the question 'Agustín ¿Qué otra comida de Guadalajara me recomiendas?' and the recorded answers: '@P1:favorite\_dish', '@P1:birthplace', and '@P1:favorite\_songs'. It also notes that 'comidas no hay nada m...' and 'la carne asada' is a favorite.
- Participante profile (c):** A network diagram showing the profile of participant P3. The profile is connected to several key terms: 'favorite\_dish', 'birria', 'berenjenas', and 'carne asada'.

# Autonomous robot vs. operator



# Closing thoughts

- Opportunities for uncovering digital biomarkers through deep learning
- Training in AI required to understand how decisions are made
  - Can a physician interpret the results of the algorithm?
- Is our data a public good?
  - Inequity in healthcare
  - Dealing with bias
  - Privacy issues
  - Who owns the data? Who benefits from it?

# La medición de la Capacidad intrínseca el rol de las tecnologías

Dr. Luis Miguel Gutiérrez Robledo

# Plan de la presentación

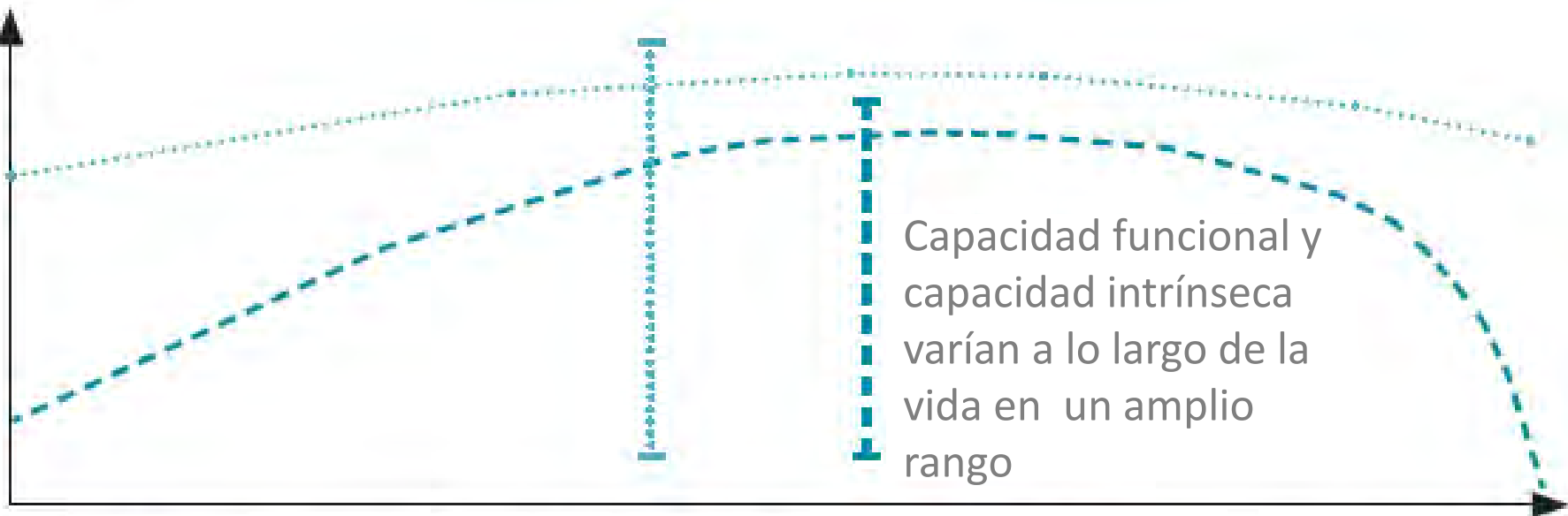
- Conceptos básicos
- El nuevo esquema de salud pública y envejecimiento
- Características de la capacidad intrínseca
- Condiciones de salud prevalentes
- Interés práctico:
  - en investigación
  - En la clínica



Desenlaces de salud  
individuales

Capacidad  
funcional

Capacidad  
intrínseca



Primeros  
1000 días

Infancia y  
adolescencia

Juventud y edad  
madura

Vejez

### Etapas del curso de la vida

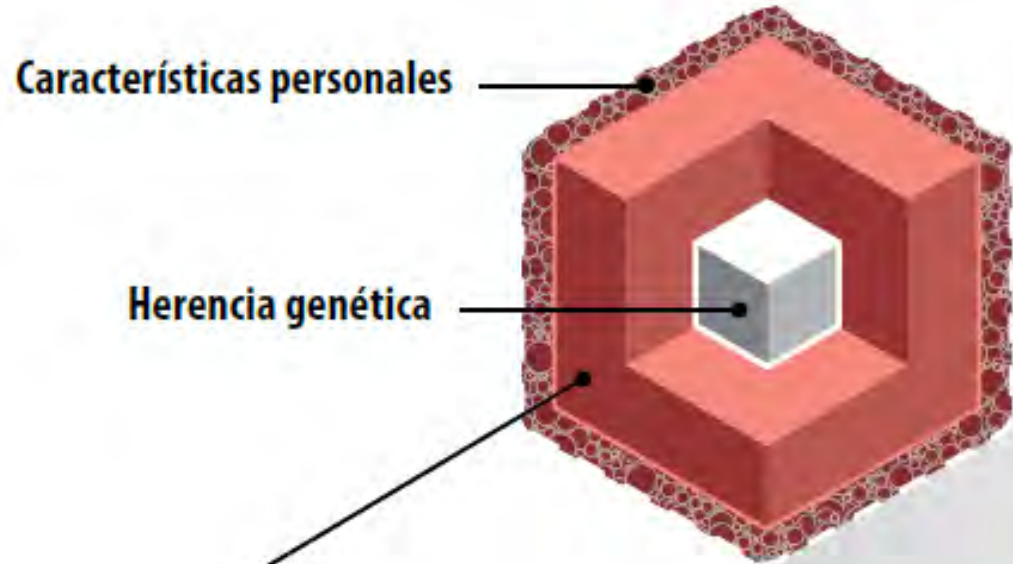
#### Determinantes económicos y sociales

Familia y comunidad, servicios de salud, sistemas y factores multisectoriales relacionados con normas, economía, política, entorno físico y desarrollo sostenible

#### Principios y prácticas para hacer efectivos los derechos

Aplicar un enfoque basado en derechos con perspectiva de género y con búsqueda de la equidad

# Capacidad intrínseca

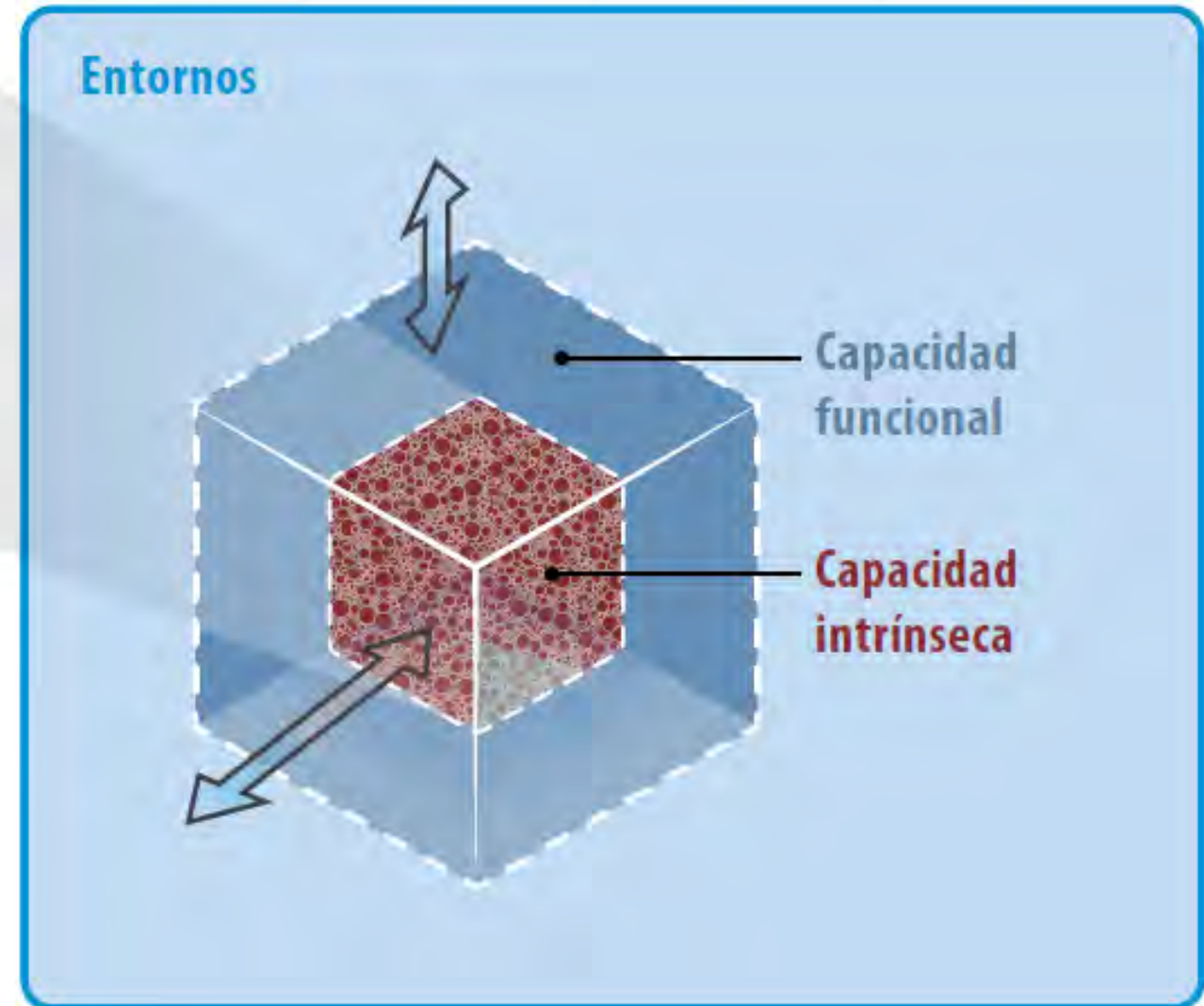


Características personales

Herencia genética

## Características de salud

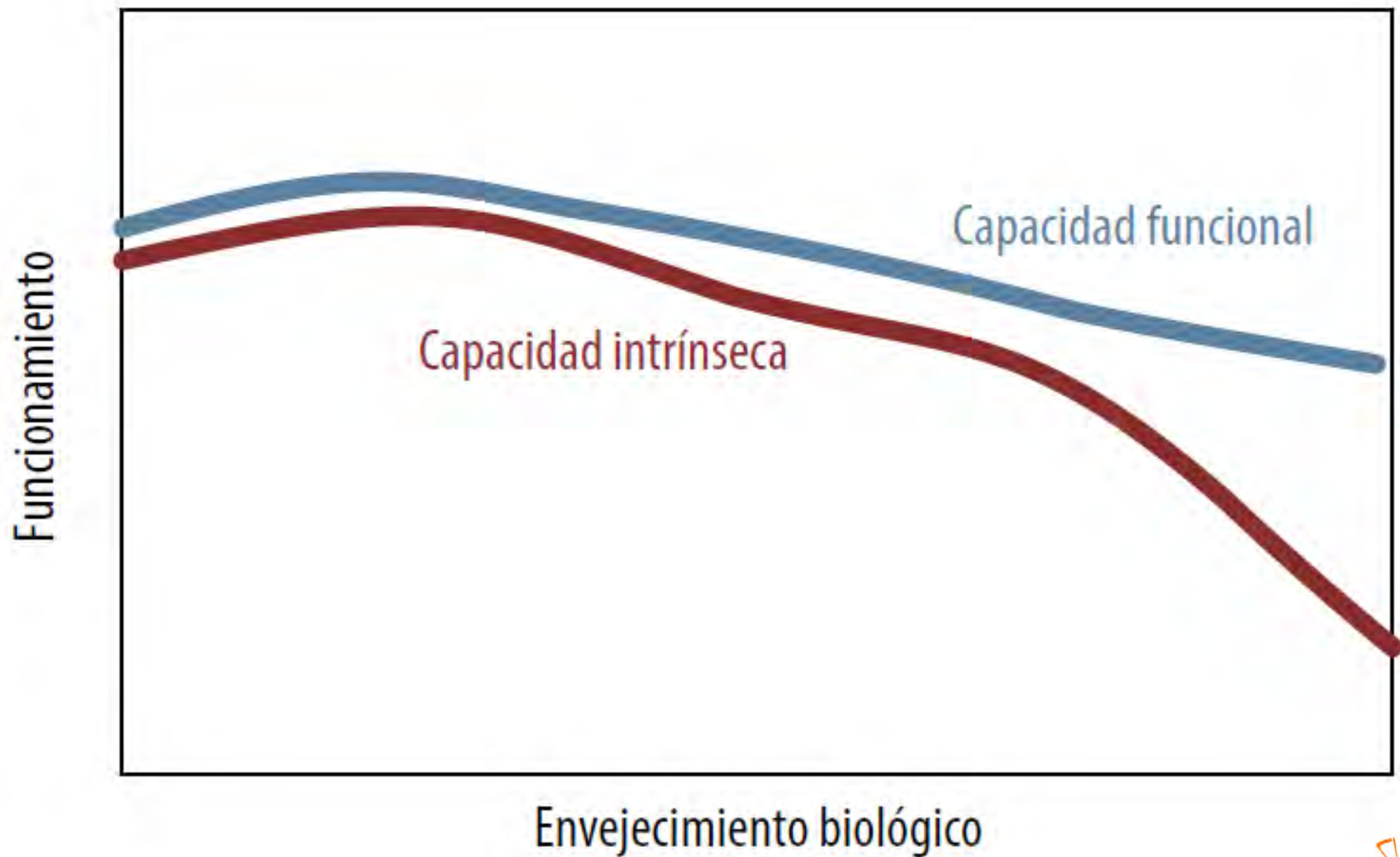
- Tendencias fundamentales relacionadas con la edad
- Hábitos de salud, rasgos y habilidades
- Cambios fisiológicos y factores de riesgo
- Enfermedades y lesiones
- Cambios en la homeostasis
- Síndromes geriátricos más generales

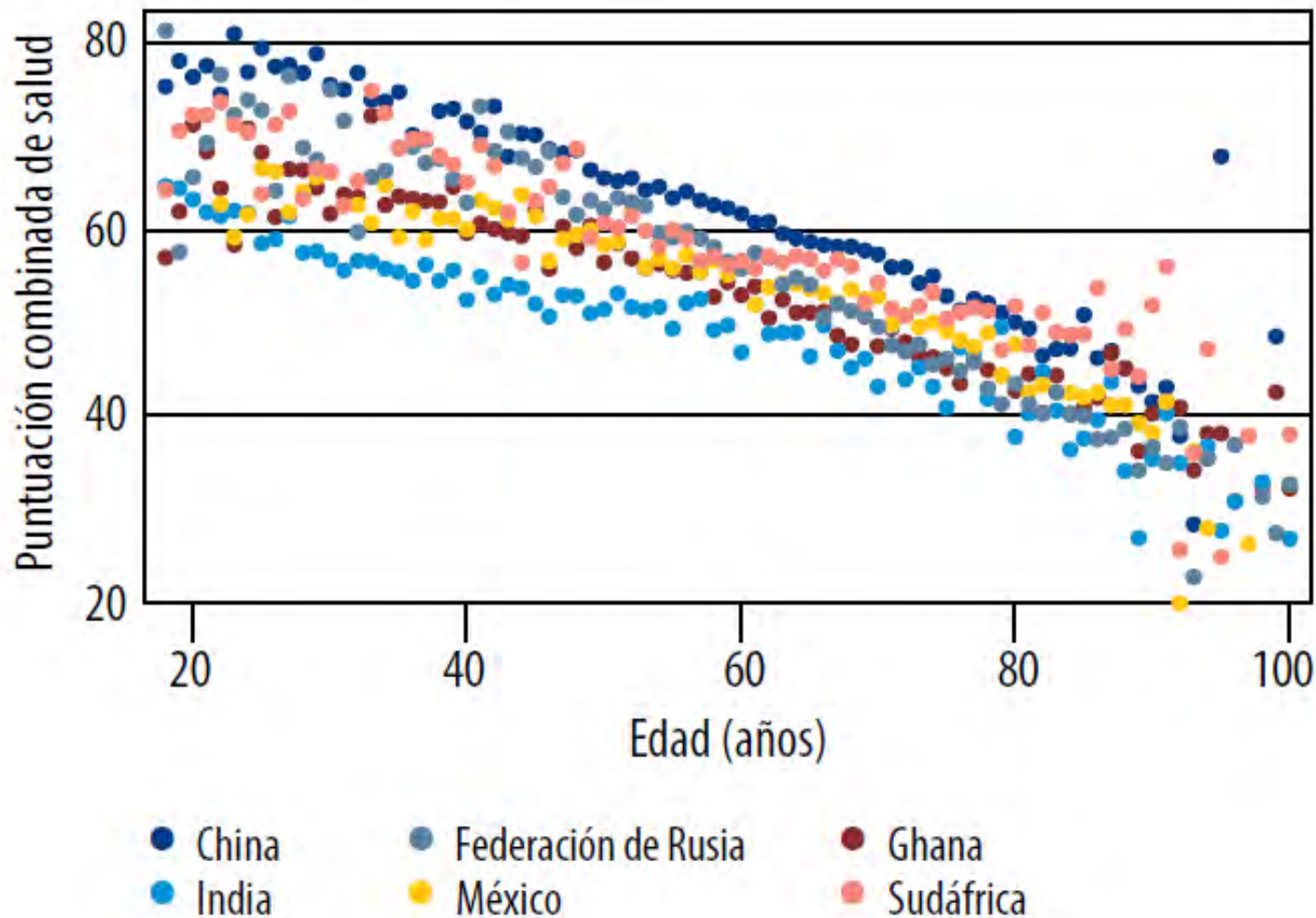


Entornos

Capacidad funcional

Capacidad intrínseca

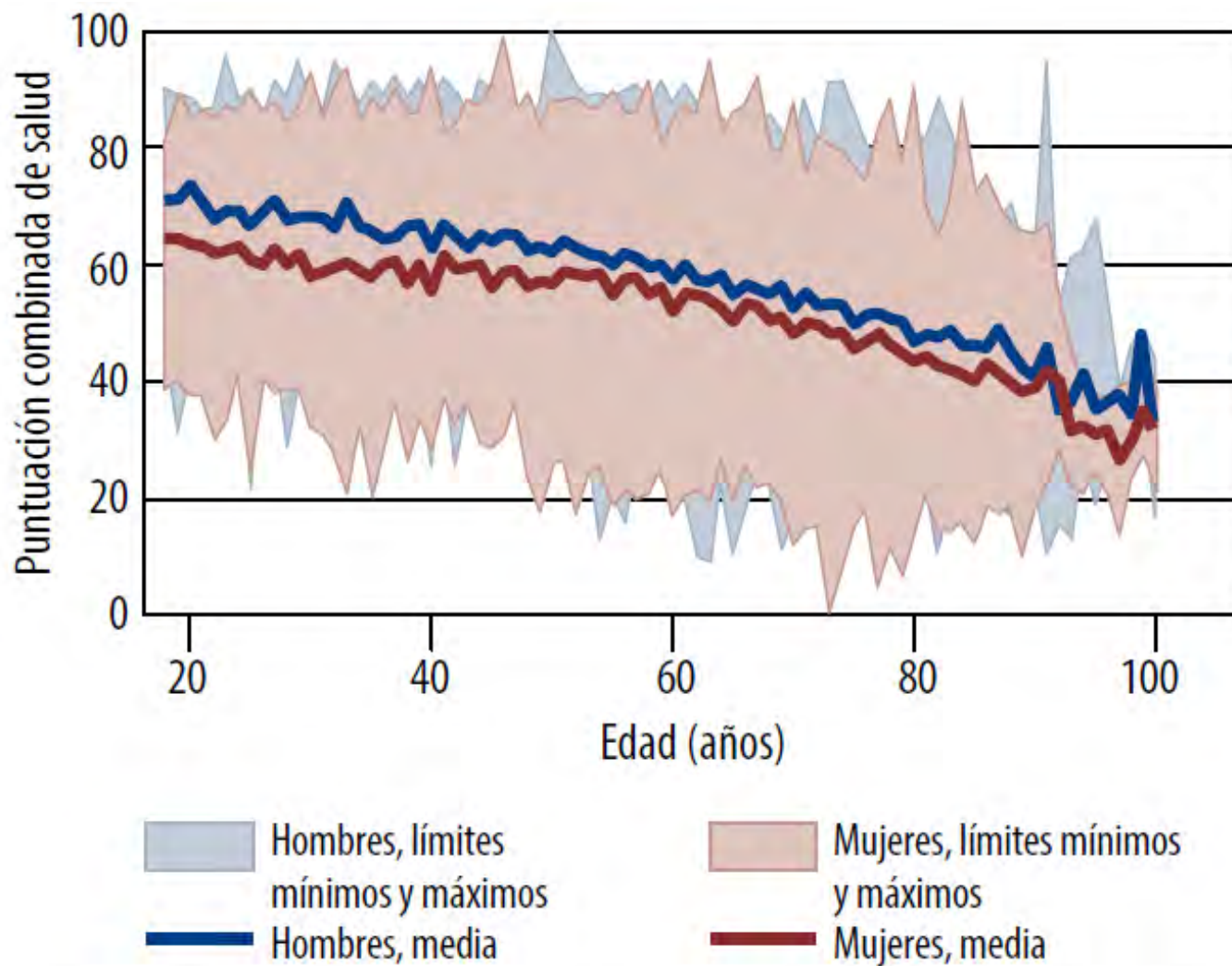




# Capacidad intrínseca a lo largo de la vida

Nota: Los datos sobre las capacidades físicas y mentales provienen del Estudio sobre envejecimiento y salud de los adultos en el mundo (SAGE) 2007–2010 (ronda 1) (34) y se usaron para elaborar un vector de la capacidad. Las cifras más altas indican mayor capacidad intrínseca.

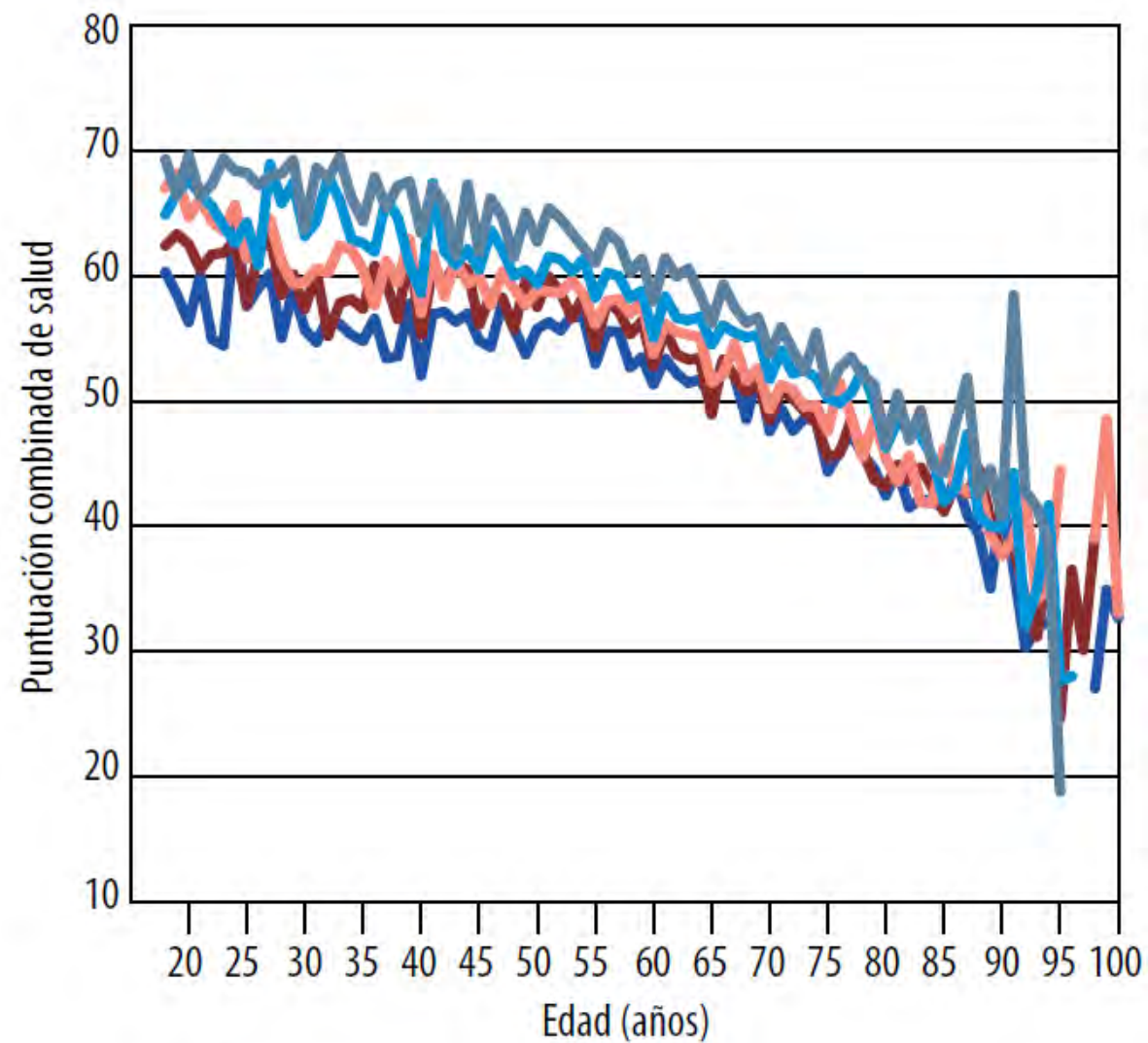




# Valores medios de Capacidad Intrínseca a lo largo de la vida

Nota: Los datos sobre las capacidades físicas y mentales provienen del estudio SAGE y se usaron para calcular una puntuación combinada de la salud. Las cifras más altas indican una mejor salud.

Fuente: (34).



Quintil de riqueza

- 1 más bajo
  2
  3
- 4
  5 más alto

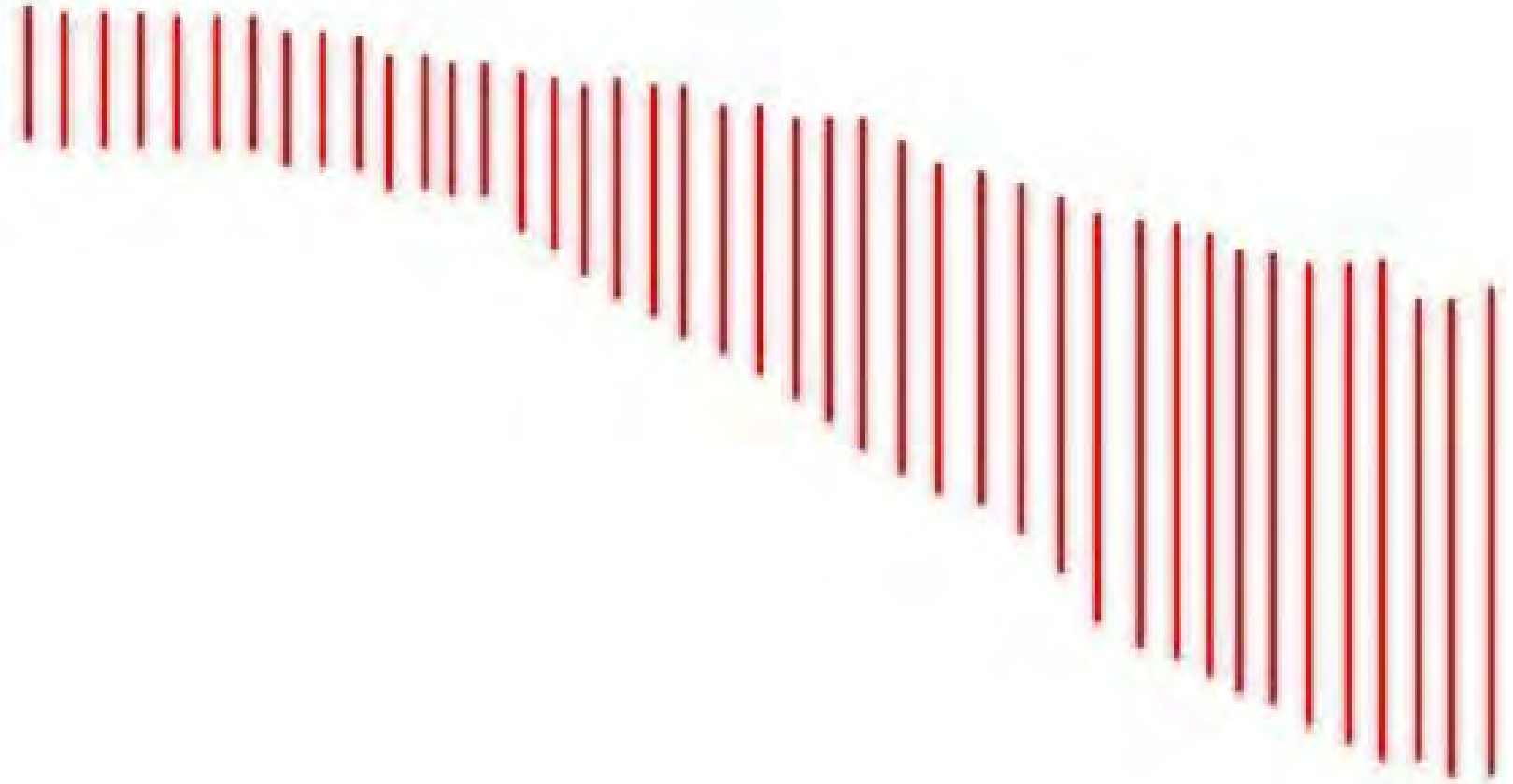
# Capacidad Intrínseca por quintil de riqueza

Nota: Las cifras más altas indican una mejor salud.

Fuente: (34).

# *Diversity of IC increases with age*

Intrinsic Capacity

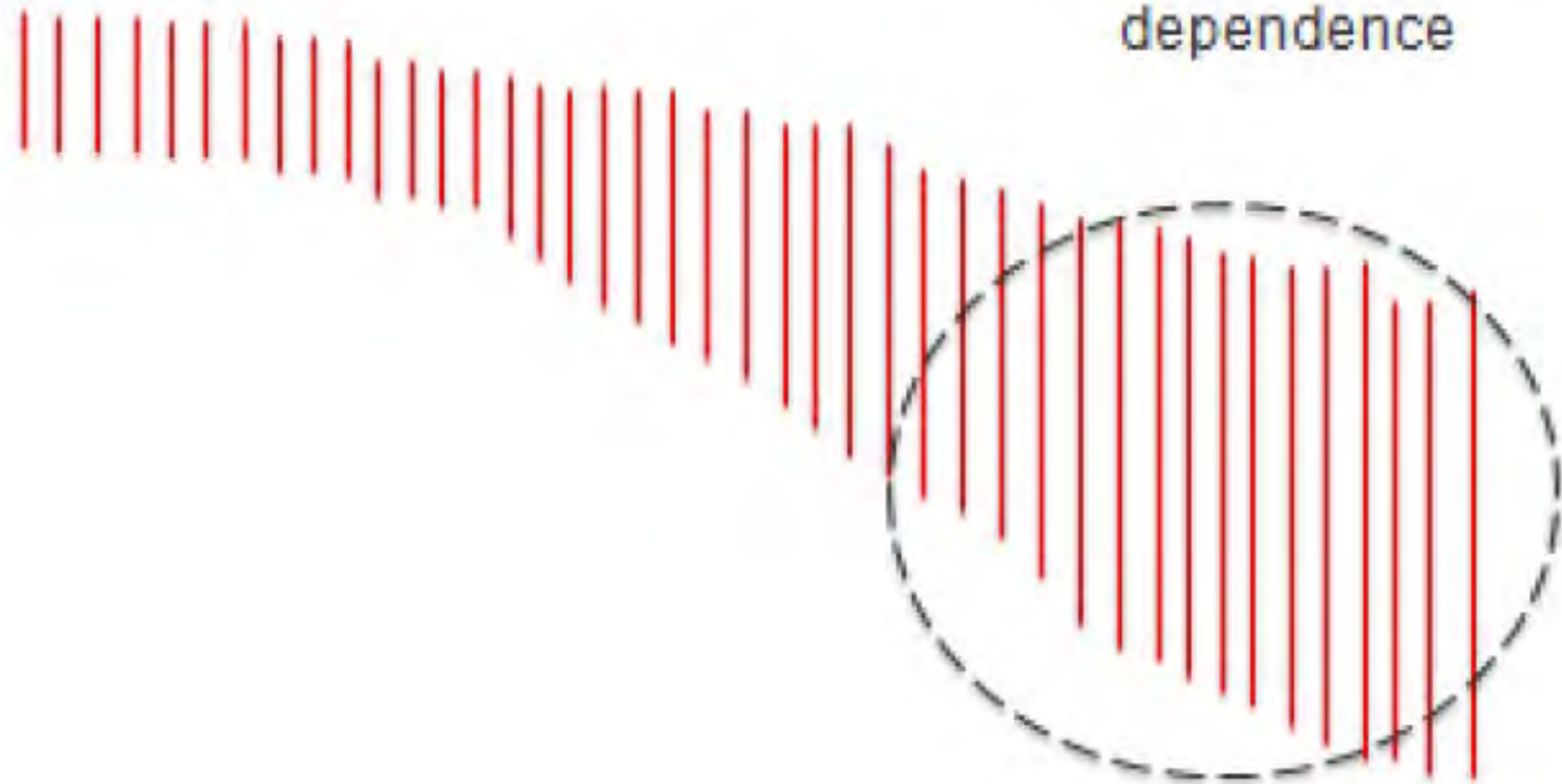


Increasing  
age group



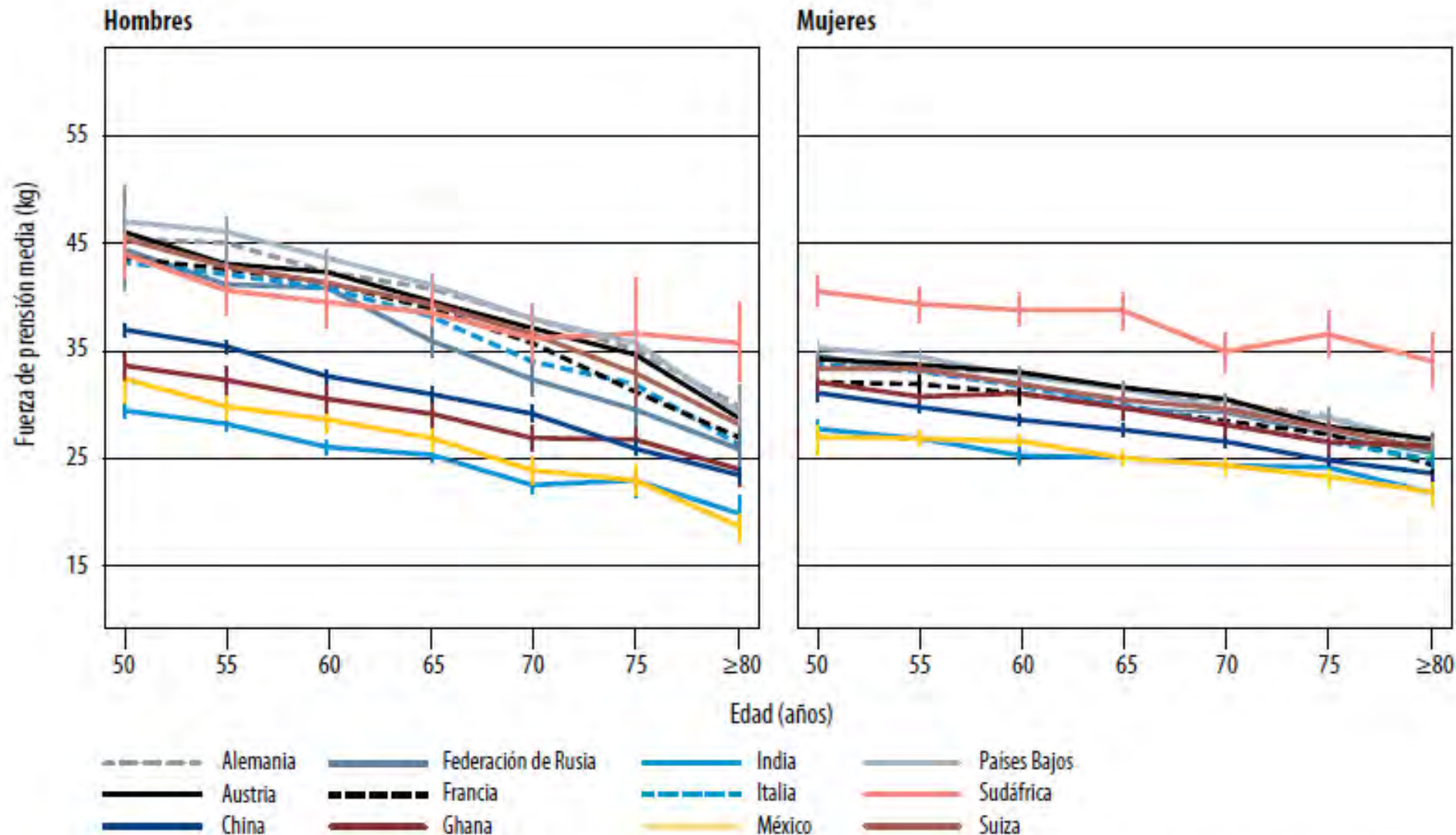
Intrinsic Capacity

Frailty, Care dependence



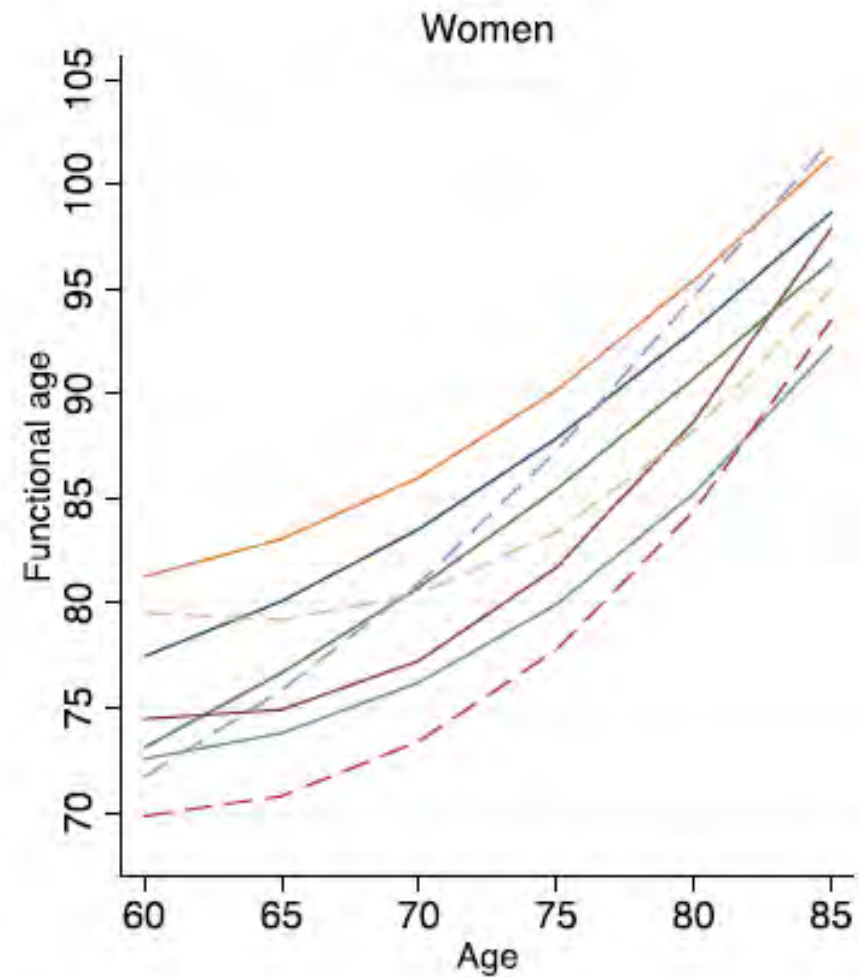
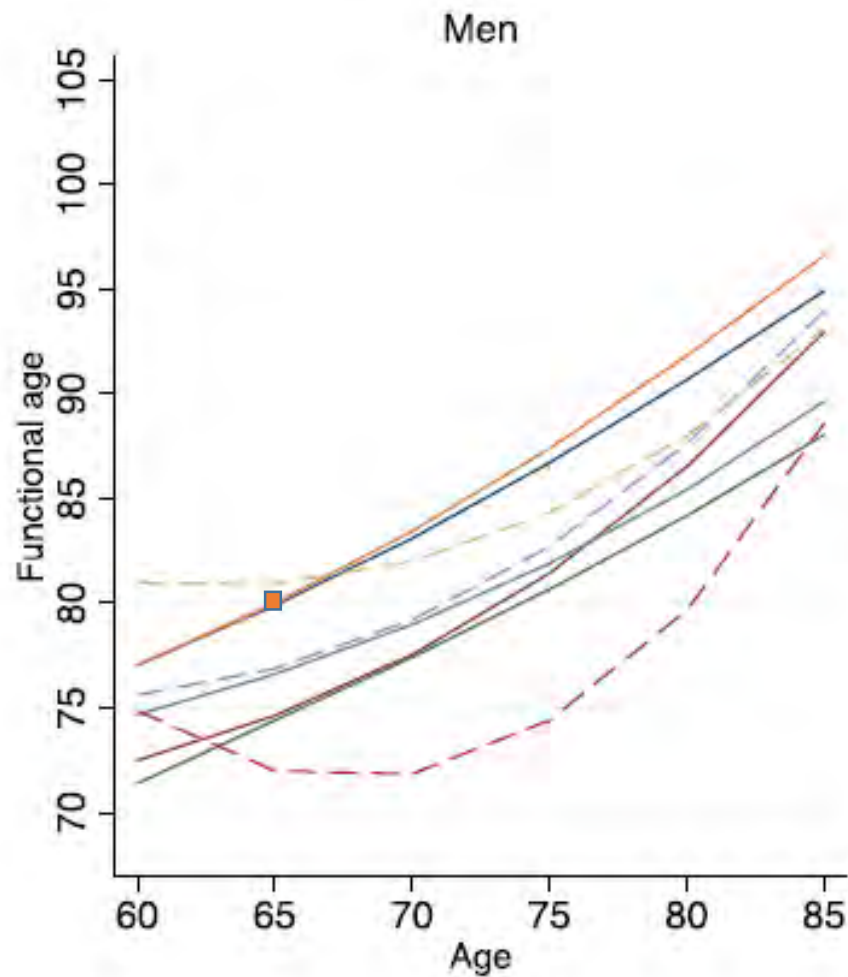
Increasing age group

# Fuerza de prensión



Nota: La figura se centra en la cuarta ronda de la encuesta SHARE (2010-2011), debido a que la implementación del proyecto coincidió aproximadamente con la primera ronda del estudio SAGE (2007-2010). Datos no ajustados por altura ni por peso.

Fuentes: (16, 34).

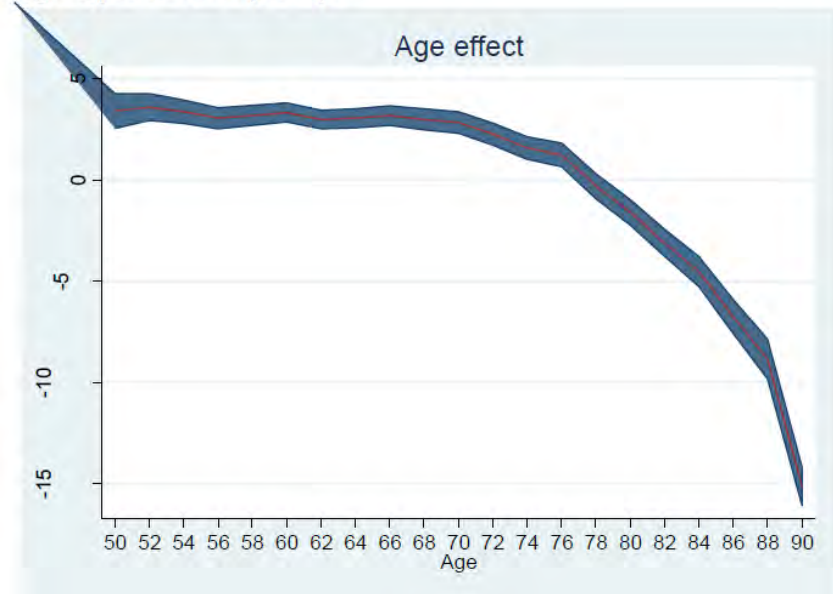


National Academies of Sciences, Engineering, and Medicine. (2018). *Future Directions for the Demography of Aging: Proceedings of a Workshop*. Washington, DC: The National Academies Press. doi: <https://doi.org/10.17226/25064>.

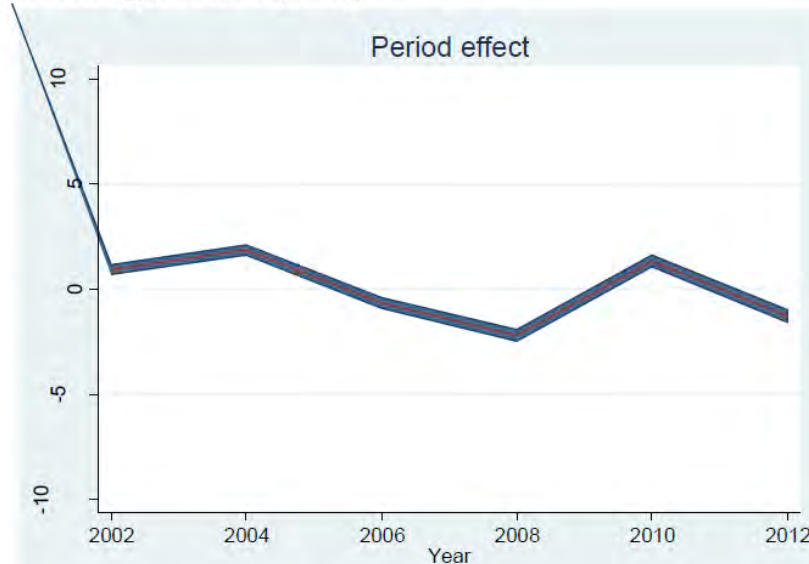
Functional and chronological age across countries separately by sex.

# Efectos de la edad, período y cohorte sobre CI

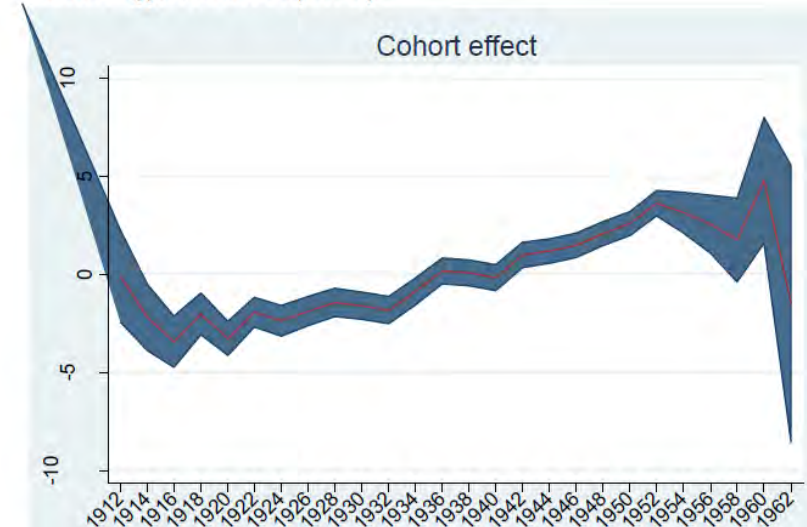
Age effects on capacity



Period effects on capacity



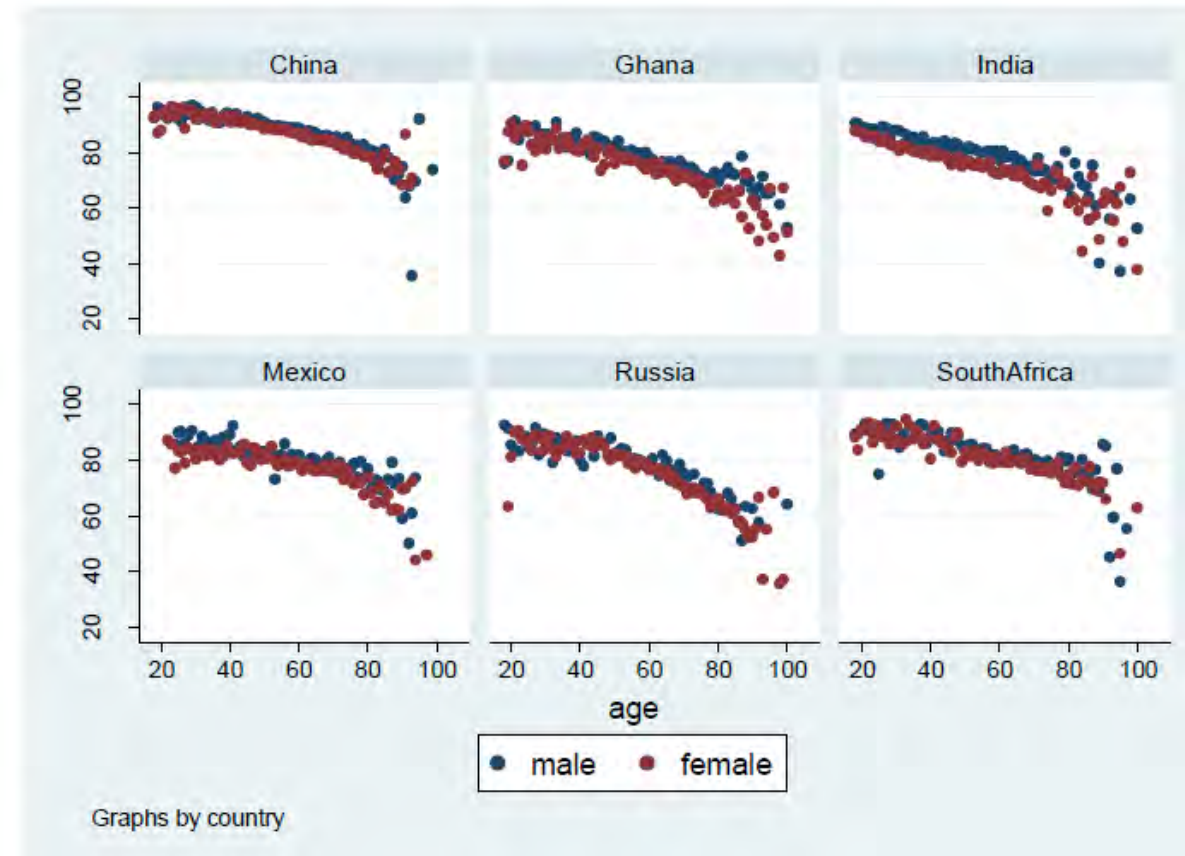
Cohort effects on capacity



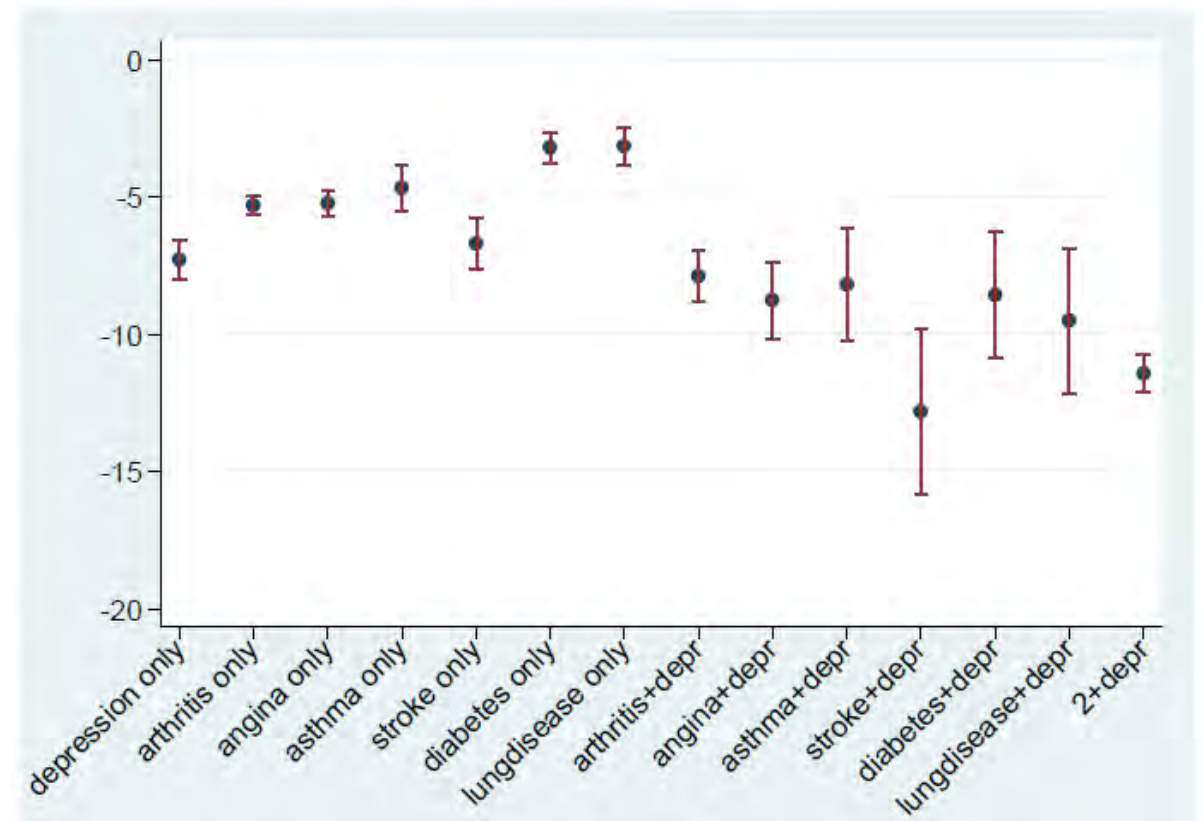


# Diferencias por países y condiciones de salud

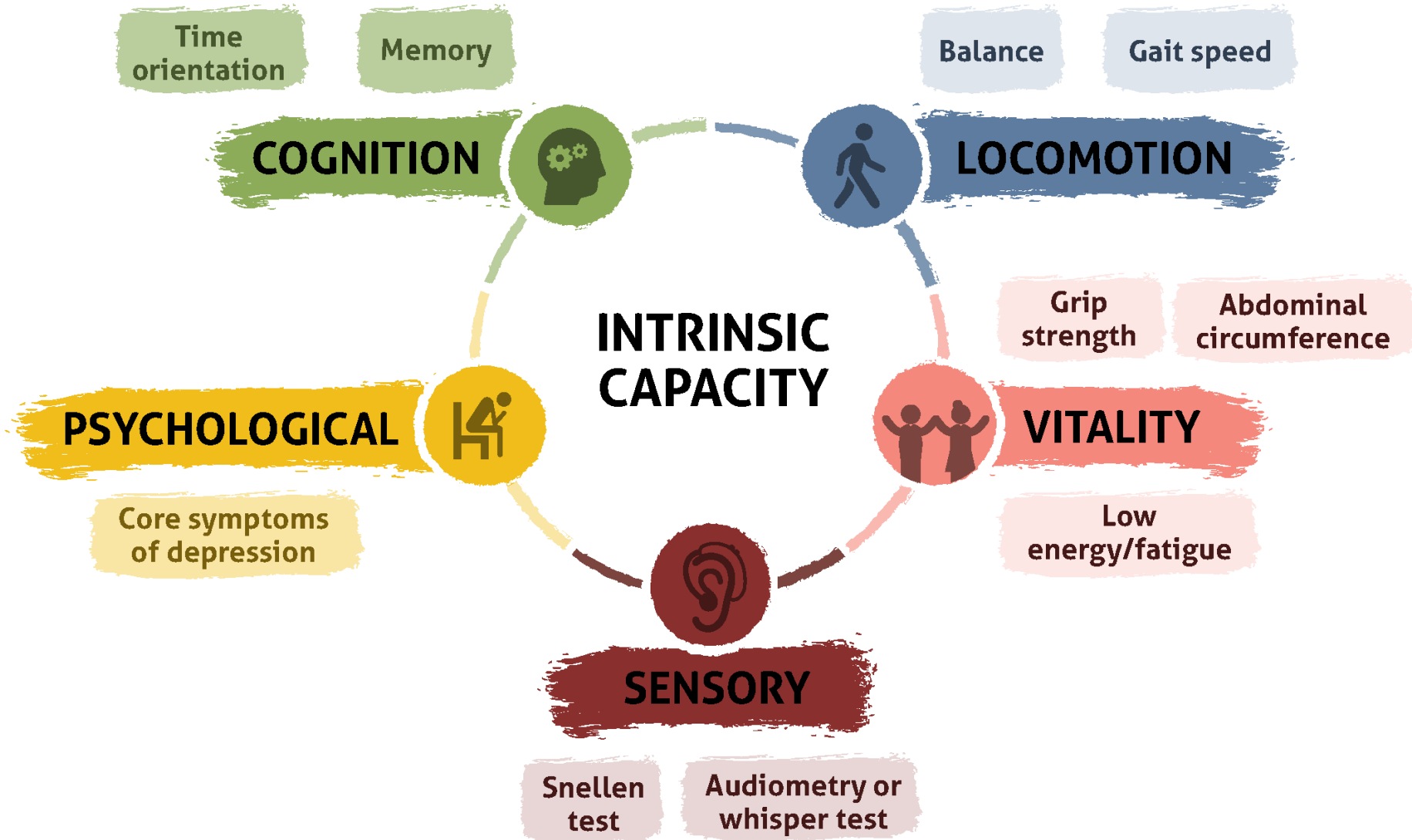
*Declines in capacity by age*



*Impact of health conditions on capacity*

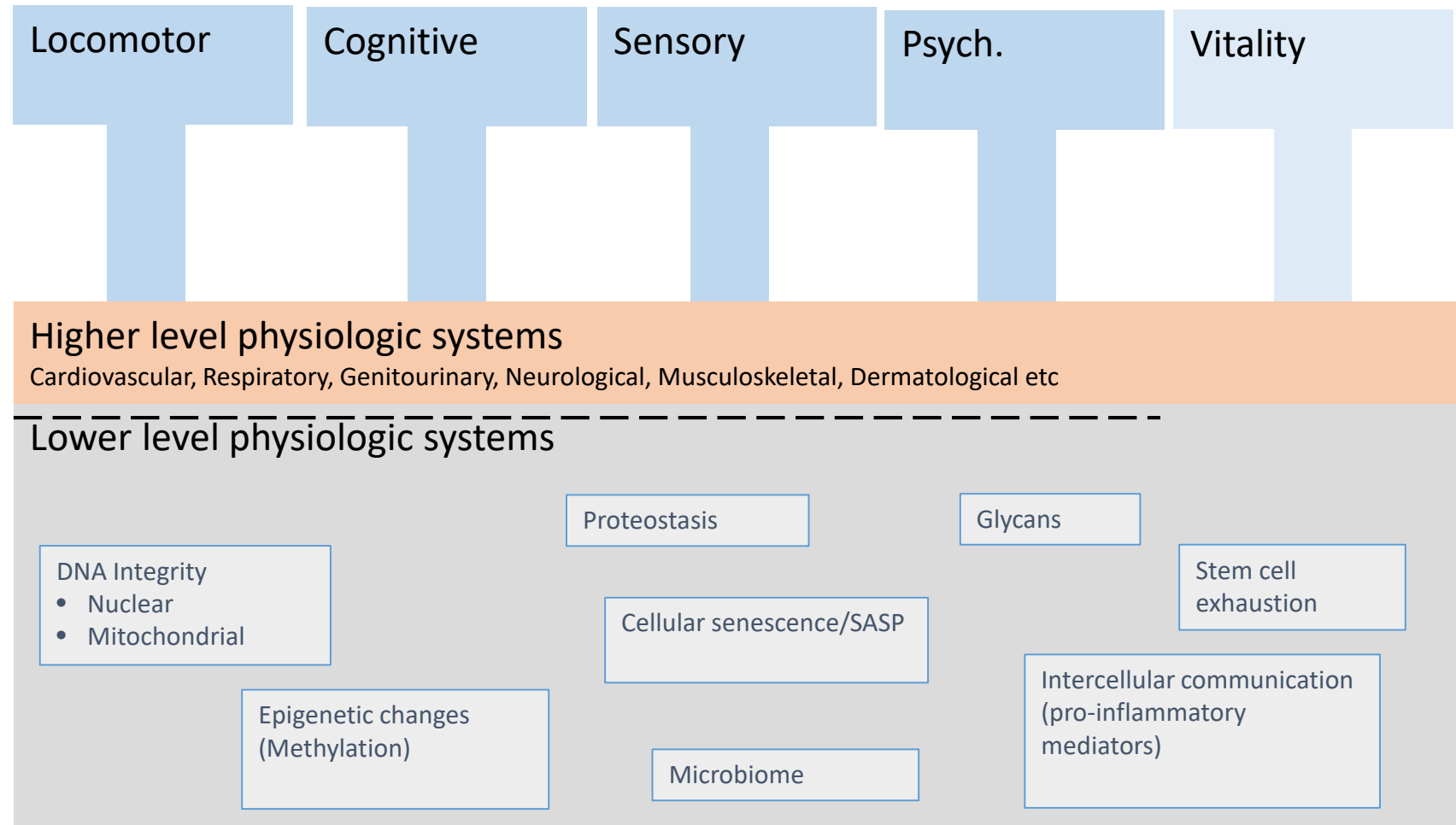


# DOMAINS OF INTRINSIC CAPACITY





# Función y Capacidad Intrínseca



# Indicadores para los dominios :

## Cognición

- Deterioro cognitivo
- Puntaje estandarizado

## Psicológico

- Síntomas de depresión (GDS-15)
- Satisfacción con la vida (Likert)
- Participación social
- Locus de Control interno y externo

## Locomoción

- *Chair stand test*
- *Gait speed*
- Agilidad

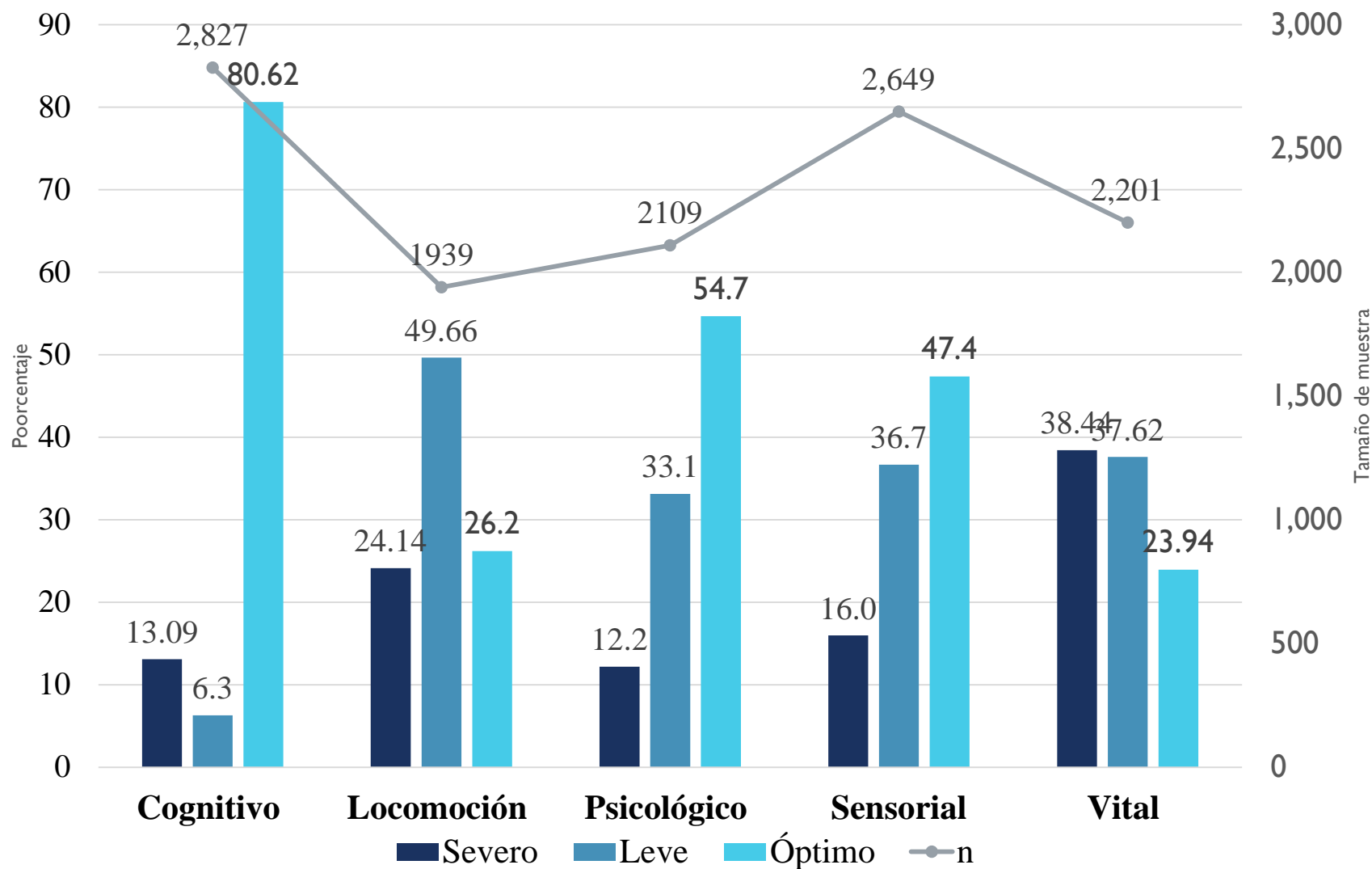
## Sensorial

- Autoreporte de valoración de la vista
- Autoreporte de la valoración de la audición

## Vitalidad

- Obesidad abdominal
- IMC
- Fuerza (*Grip strength*)
- Función pulmonar (Peak breathing Flow)

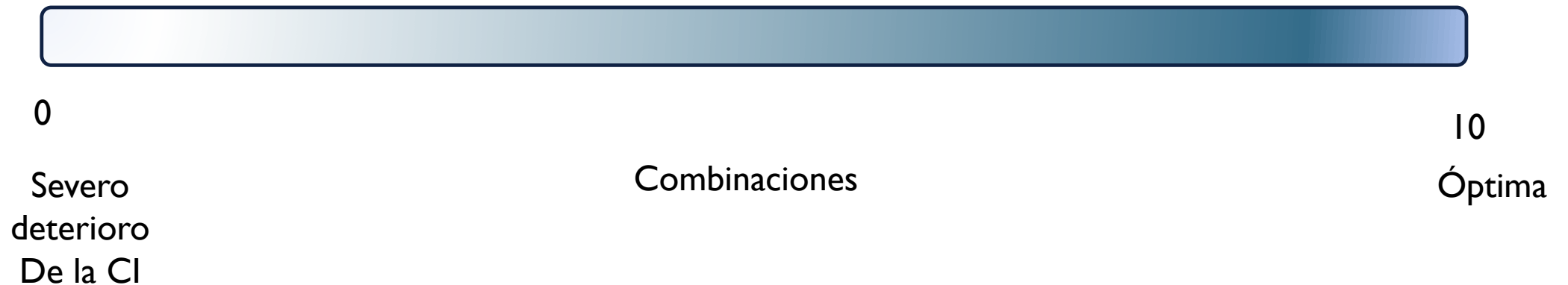
Grado de afectación de la capacidad intrínseca por dominios, CRELES 2005



# DETERIORO DE LA CAPACIDAD INTRÍNSECA EN CONJUNTO

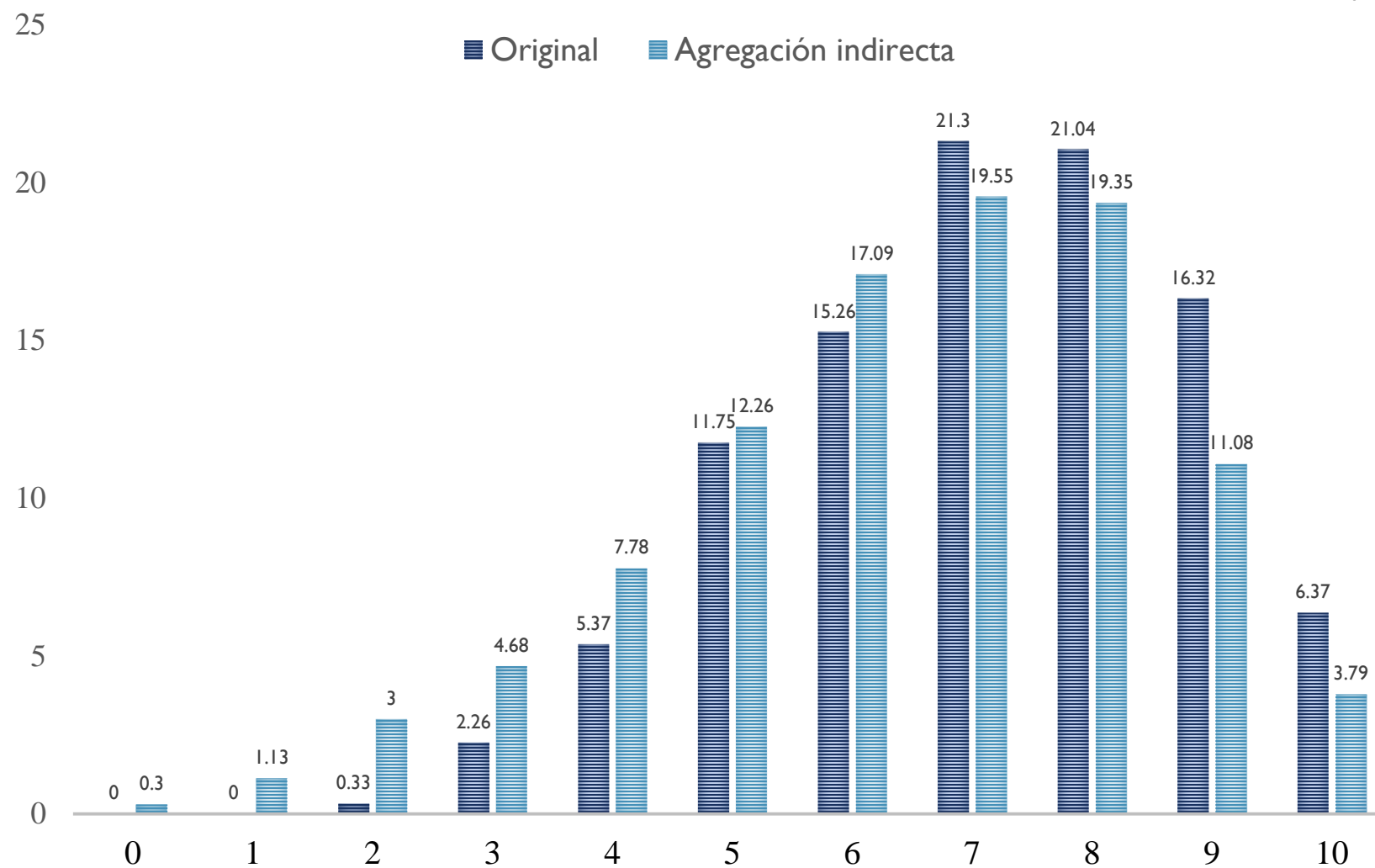
A partir del clusters definidos para cada dominio:

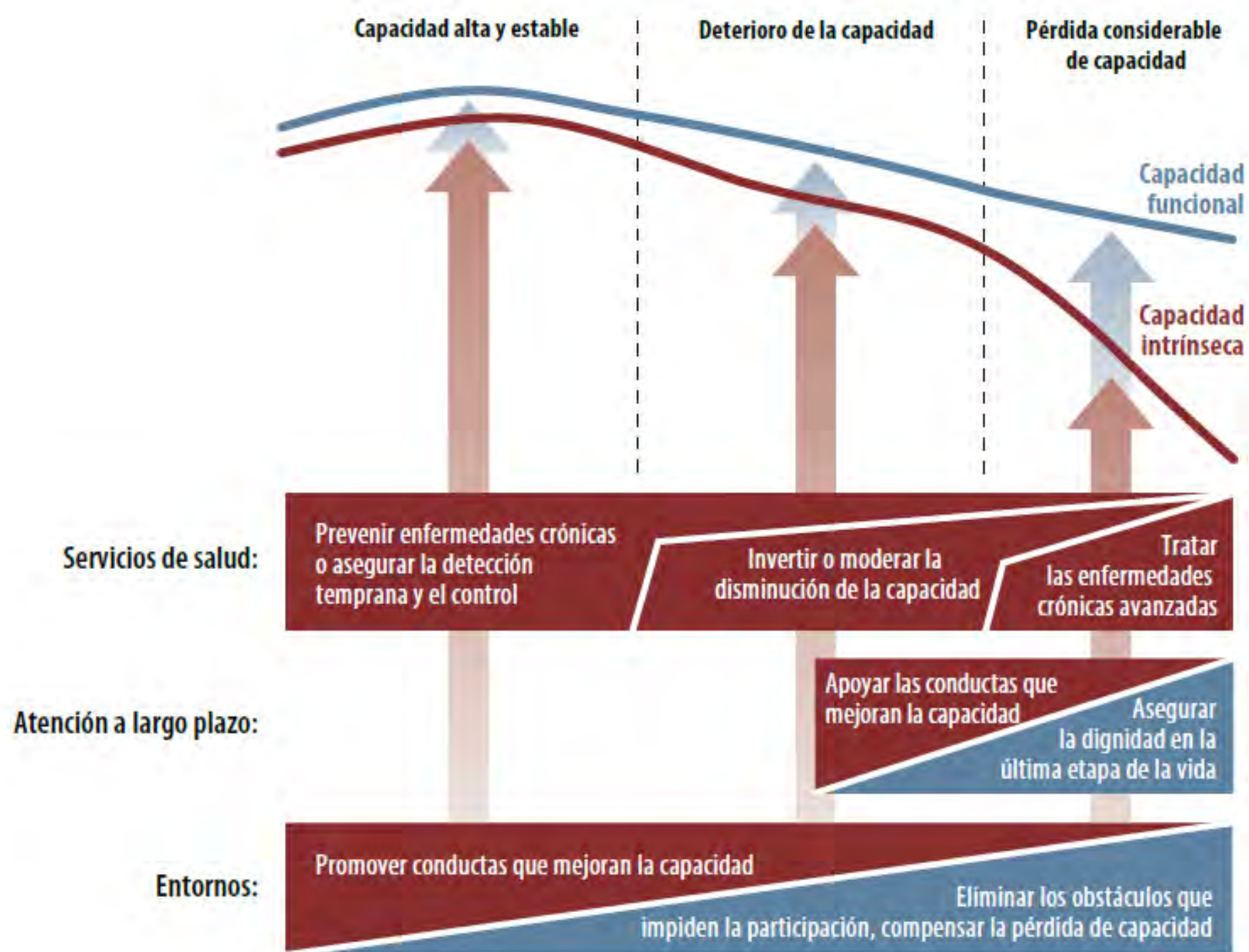
Cognitivo	Locomoción	Psicológico	Sensorial	Vital
Deterioro (0)	Deterioro (0)	Deterioro (0)	Deterioro (0)	Deterioro (0)
Medio (1)	Medio (1)	Medio (1)	Medio (1)	Medio (1)
Óptimo (2)	Óptimo (2)	Óptimo (2)	Óptimo (2)	Óptimo (2)



## DISTRIBUCIÓN PORCENTUAL DE LA PUNTUACIÓN DE LA CAPACIDAD INTRÍNSECA

n=1605  
n=2,031  
(agregación)

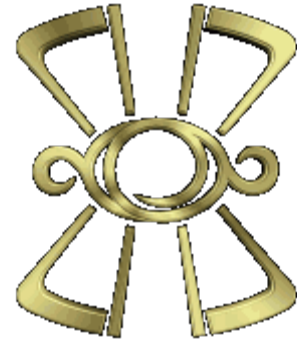






# Conclusiones

- Capacidad intrínseca, concepto en evolución
- Cambio de paradigma hacia un concepto de salud positiva
- Cambio de paradigma de un enfoque centrado en la enfermedad a uno centrado en la persona
- Interés para la estratificación del riesgo
- Clave para el proceso de toma de decisiones



Gracias.....

# Epidémiologie du syndrome de de fragilité et stratégies d'intervention

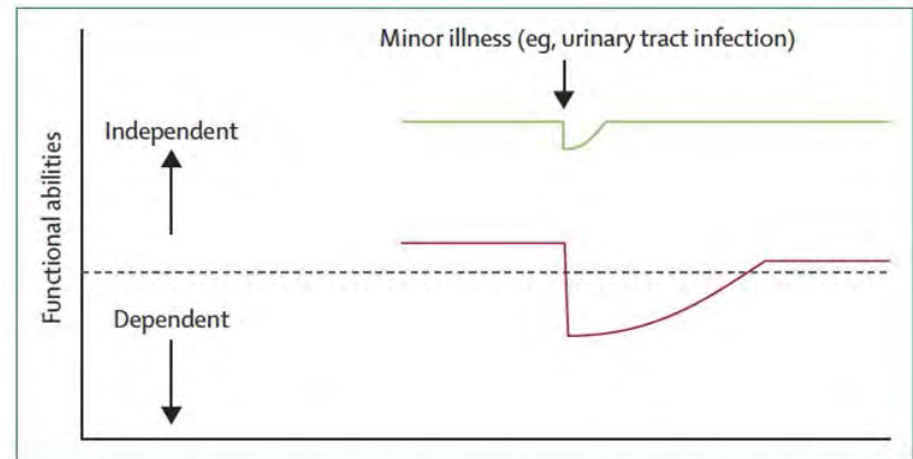
Prof Hélène Amieva

Mexico, Jeudi 22 novembre 2018



# Concept de fragilité

= Diminution des réserves physiologiques d'une personne qui altère ses mécanismes d'adaptation au stress et l'expose au risque d'évolution défavorable et d'effets néfastes sur sa santé.



**Figure 1: Vulnerability of frail elderly people to a sudden change in health status after a minor illness**

The green line represents a fit elderly individual who, after a minor stressor event such as an infection, has a small deterioration in function and then returns to homeostasis. The red line represents a frail elderly individual who, after a similar stressor event, undergoes a larger deterioration, which may manifest as functional dependency, and who does not return to baseline homeostasis. The horizontal dashed line represents the cutoff between dependent and independent.

Clegg A et al. *Lancet* 2013;381(9868):752-6

# 2 grandes conceptions de la fragilité

- Accumulation de déficits (Rockwood et Mitniski, J Gerontol 2007)

- Phénotype fragile (Fried et al, J Gerontol 2001)

- Changes in everyday activities
- Head and neck problems
- Poor muscle tone in neck
- Bradykinesia, facial
- Problems getting dressed
- Problems with bathing
- Problems carrying out grooming
- Urinary incontinence
- Toileting problems
- Bulk difficulty
- Rectal problems
- Gastrointestinal problems
- Problems cooking
- Sucking problems
- Problems going out
- Impaired mobility
- Musculoskeletal problems
- Bradykinesia of the limbs
- Poor muscle tone in limbs
- Poor limb coordination
- Poor coordination, trunk
- Poor standing posture
- Irregular gait pattern
- Falls
- Mood problems
- Feeling sad, blue, depressed
- History of depressed mood
- Tiredness
- Impaired vibration
- Tremor at rest
- Postural tremor
- Intention tremor
- History of Parkinson disease
- Family history of degenerative disease

- Seizures, partial complex
- Seizures, generalized
- Syncope or blackouts
- Headache
- Cerebrovascular problems
- History of stroke
- History of diabetes mellitus
- Arterial hypertension
- Peripheral pulses
- Cardiac problems
- Myocardial infarction
- Arrhythmia
- Congestive heart failure
- Lung problems
- Respiratory problems
- History of thyroid disease
- Thyroid problems
- Skin problems
- Malignant disease
- Breast problems
- Abdominal problems
- Presence of snout reflex
- Presence of palmomental reflex
- Other medical history

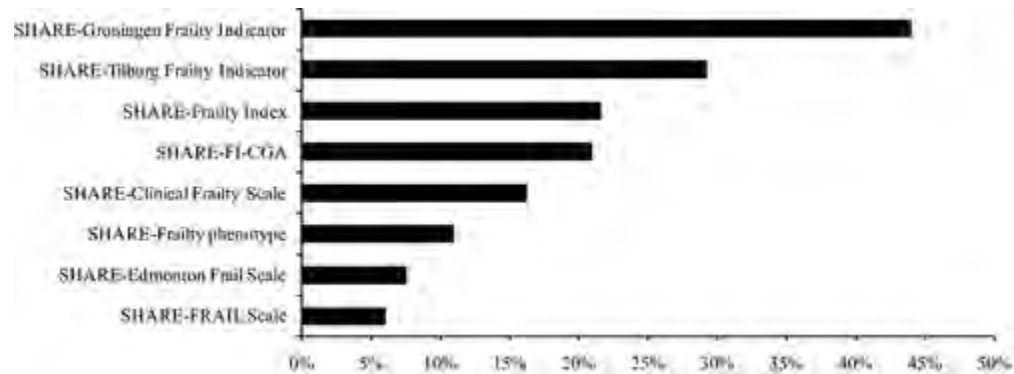
**Ratio nb déficits  
 présents / nb déficits  
 explorés**

## 5 critères :

- Perte de poids involontaire
- Fatigue
- Anémie
- L
- Fa

**Robuste** = aucun  
 critère de fragilité  
**Pré-fragile** = 1 ou 2  
 critères de fragilité  
**Fragile** = 3 critères de  
 fragilité ou plus

# Variabilité de la prévalence... selon la définition



Theou et al, JAGS 2013

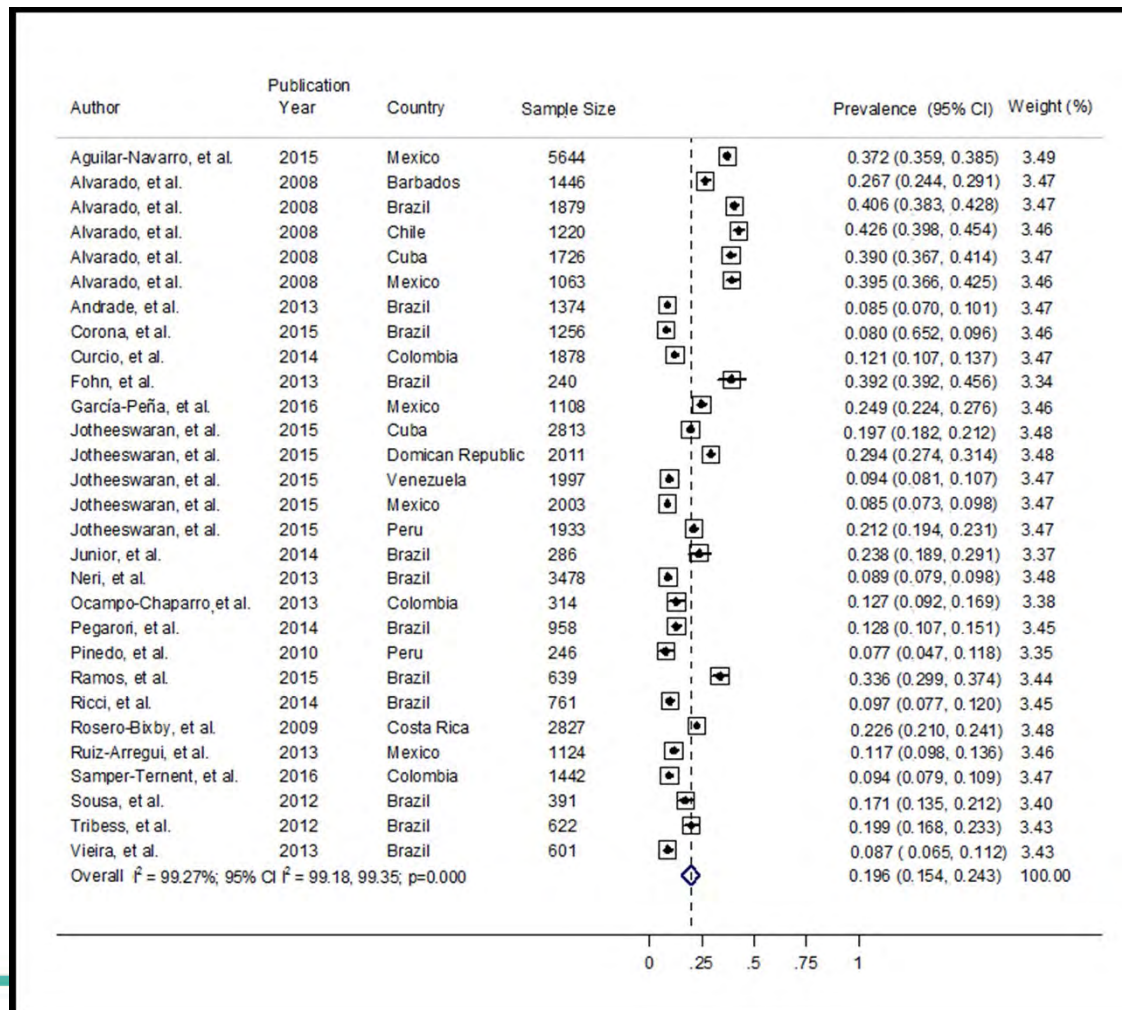


# Variabilité de la prévalence... selon la sélection de l'échantillon

Données population française (phénotype fragile)

- Parmi les sujets  $\geq 65$  ans inclus dans l'étude des 3 cités en 1999-2000 (Avila-Funes et al, JAGS 2009) : 7,0%
- Même cohorte, suivi à 10 ans : (Tabue-Teguo et al, J Gerontol A Biol Sci Med Sci 2017) : 12%
- Parmi les sujets  $\geq 65$  ans inclus dans l'étude SHARE en 2004 (Santos-Eggiman et al, J Gerontol A 2009) : 13,5% (IC95% 12,2-14,7)
- Parmi les sujets de la cohorte GAZEL, âgés de 58 à 73 ans en 2012 (Linard et al, JNHA 2015) : 14,2% (IC95% 13,6-14,8)
- Parmi les sujets  $\geq 75$  ans inclus dans l'étude HID (Renaut et al, Gérontologie et société 2004) : 33% (IC95% 15,4-18,5)

# Variabilité de la prévalence... selon les pays





	Year	Country	Participants (n)	Length of follow-up (years)	Falls (HR*/OR† [95% CI])		Worsening disability (HR*/OR† [95% CI])		Hospitalisation (HR*/OR† [95% CI])		Care home admission (HR*/OR† [95% CI])		Mortality (HR*/OR† [95% CI])	
					Inter-mediate frailty	Severe frailty	Inter-mediate frailty	Severe frailty	Inter-mediate frailty	Severe frailty	Inter-mediate frailty	Severe frailty	Inter-mediate frailty	Severe frailty
Cardiovascular Health Study (CHS) <sup>93</sup>	2001	USA	5317	7	1.12* (1.00-1.26)	1.23* (1.50-2.21)	1.55* (1.38-1.75)	1.79* (1.47-2.17)	1.11* (1.03-1.19)	1.27*, (1.11-1.46)	NA	NA	1.32* (1.13-1.55)	1.63* (1.27-2.08)
Canadian Study of Health and Aging (CSHA) <sup>92</sup>	2004	Canada	9008	5	NA	NA	NA	NA	NA	NA	2.54† (1.67-3.86)	2.60† (1.36-4.96)	2.54† (1.92-3.37)	3.69† (2.26-6.02)
Women's Health and Aging Study (WHAS) <sup>93</sup>	2006	USA	1438	3	0.92* (0.63-1.64)	1.18* (0.63-2.19)	NA	NA	0.99* (0.67-1.47)	0.67* (0.33-1.35)	5.16* (0.81-32.79)	23.98* (4.45-129.2)	3.50* (1.91-6.39)	6.03* (3.00-12.08)
Study of Osteoporotic Fractures (SOF) <sup>94</sup>	2008	USA	6701	4.5	1.23† (1.02-1.48)	2.44† (1.95-3.04)	1.89†, (1.66-2.14)	2.79† (2.31-3.37)	NA	NA	NA	NA	1.54† (1.40-1.69)	2.75* (2.46-3.07)

HR=hazard ratio. NA=not available. OR=odds ratio. \*Hazard ratio. †Odds ratio. The comparator for hazard ratios and odds ratios is people who are not frail.

**Table:** Covariate-adjusted associations between frailty and adverse outcomes (falls, disability, hospitalisation, care home admission, and mortality) from four large prospective cohort studies





Contents lists available at ScienceDirect

## Archives of Gerontology and Geriatrics

journal homepage: [www.elsevier.com/locate/archger](http://www.elsevier.com/locate/archger)



### Comparing the predictive value of three definitions of frailty: Results from the Three-City study.



Magali Gonzalez-Colaço Harmand<sup>a,\*</sup>, Céline Meillon<sup>a</sup>, Valérie Bergua<sup>a</sup>, Maturin Tabue Teguo<sup>a</sup>, Jean-François Dartigues<sup>a,b</sup>, José Alberto Avila-Funes<sup>a,c</sup>, Hélène Amieva<sup>a</sup>

<sup>a</sup> Centre de recherche Inserm, Université de Bordeaux, Bordeaux, U 1219, France

<sup>b</sup> Institut des Maladies Neurodégénératives Clinique, Centre Hospitalier Universitaire de Bordeaux, France

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L'index de Tilburg, l'index de Fragilité et le phénotype de Fragilité sont tous prédicteurs d'évènements de santé défavorables dans ce travail mais la force de prédiction varie en fonction de l'outil et de l'évènement à prédire.

# Intérêts du concept de fragilité

## Pronostic :

Prédire des événements  
de santé défavorables  
chez une personne âgée

## Prévention :

Identifier une population  
cible susceptible de bénéficier  
de stratégies d'intervention

# Interventions visant à réduire le risque de devenir fragile ou diminuer le niveau de fragilité : revue de la littérature

## Critères de sélection des études :

- Population d'étude : sujets âgés fragiles (diverses définitions)
- Essais contrôlés randomisés



# Interventions visant à réduire le risque de devenir fragile ou diminuer le niveau de fragilité : revue de la littérature

## Activité physique

Détail intervention	Auteurs	N	Age moyen
Pour toutes ces études : exercices en groupes force, étirements, équilibre, exercices aérobic, coordination, souplesse...	Cesari et al 2015	424	76,8
	Binder et al 2002	119	83
	Gine-Garriga et al 2010	51	84,1
	Gill et al 2003	188	83
	Trombetti et al 2018	1635	78,9

# Interventions visant à réduire le risque de devenir fragile ou diminuer le niveau de fragilité : revue de la littérature

## Activité physique + Nutrition

Détail intervention	Auteurs	N	Age
consultation nutrition + activité physique	Chan et al 2012	117	71,4
supplémentation graisse de lait + activité physique	Kim et al 2015	131	81
éducation nutritionnelle + activité physique	Kwon et al 2015	89	76,8
éducation nutritionnelle + activité physique	Tarazona-Santabalbina et al 2016	100	79,7

# Interventions visant à réduire le risque de devenir fragile ou diminuer le niveau de fragilité : revue de la littérature

## Activité physique + Nutrition + Mémoire

Déatil intervention	Study	N	Age
Exercices d'activité physique en groupes + Supplémentation fer, folate, vitamine B6, B12, D, calcium + Exercices de stimulation mémoire à court terme, attention, vitesse, raisonnement, résolution de problème.	Ng et al 2015	246	70

# Interventions visant à réduire le risque de devenir fragile ou diminuer le niveau de fragilité : revue de la littérature

## Evaluation gériatrique

Détail intervention	Study	N	Age
Evaluation gériatrique et prise en charge multifactorielle	Li et al 2010	310	78,4
	Cameron et al 2013	241	83,3
	Gustaffsson et al 2012	459	86



Intervention	Etude	Résultats
Activité physique	Cesari et al 2015	<b>Prévalence de fragilité inférieure</b>
	Binder et al 2002	<b>Amélioration mesures physiques / pas fonctionnelles</b>
	Gill et al 2003	<b>Diminution du score de fragilité</b>
	Gine-Garriga et al 2010	<b>Amélioration mesures physiques</b>
	Trombetti et al 2018	<b>Pas d'effet</b>
Activité physique + nutrition	Chan et al 2012	<b>Prévalence fragilité inférieure</b>
	Kim et al 2015	<b>Prévalence fragilité inférieure</b>
	Kwon et al 2015	<b>Amélioration mesures force préhension</b>
	Tarazona-Santabalbina et al 2016	<b>Diminution du score de fragilité</b>
Activité physique + nutrition + cognition	Ng et al 2015	<b>Diminution du score de fragilité</b>
Evaluation gériatrique	Li et al 2010	<b>Pas d'effet</b>
	Cameron et al 2013	<b>Prévalence de fragilité inférieure</b>
	Gustaffsson et al 2012	<b>Pas d'effet</b>

# Synthèse des résultats (1)

- Au total, peu de RCT
- Définition marqueurs de la fragilité variable d'une étude à l'autre
- Durée intervention très variable : de qq semaines (Gustaffsson et al 2012) à 24 mois (Trombetti et al 2018)
- Qualité méthodologique des études : moyenne
  - « Intention-to-treat analysis » questionnable pour 4 études (Binder et al 2002, Gine-Garriga et al 2010, Kim et al 2015, Kwon et al 2015)
  - Pas de description de la procédure de randomisation, d'évaluation en aveugle pour 5 études (Ng et al 2015, Binder et al 2002, Gine-Garriga et al 2010, Tarazona-Santabalbina et al 2016, Li et al 2010)
  - Echantillon sous-dimensionné pour au moins 3 études (Kwon et al 2015, Tarazona-Santabalbina et al 2016, Gine-Garriga et al 2010)



## Synthèse des résultats (2)

- Les études les moins « robustes » sont celles qui rapportent le plus d'effet  
*A contrario : l'étude avec l'échantillon le + grand et la durée d'intervention la + longue : pas d'effet (étude Life, Trombetti et al 2018)*
- Bonne faisabilité : taux d'adhésion satisfaisants et très peu d'évènements indésirables rapportés
- Efficacité des interventions mitigée : 7 sur 13 rapportent un impact sur les marqueurs de fragilité
- Peu de données sur le maintien des effets à long terme

# Perspectives (1)

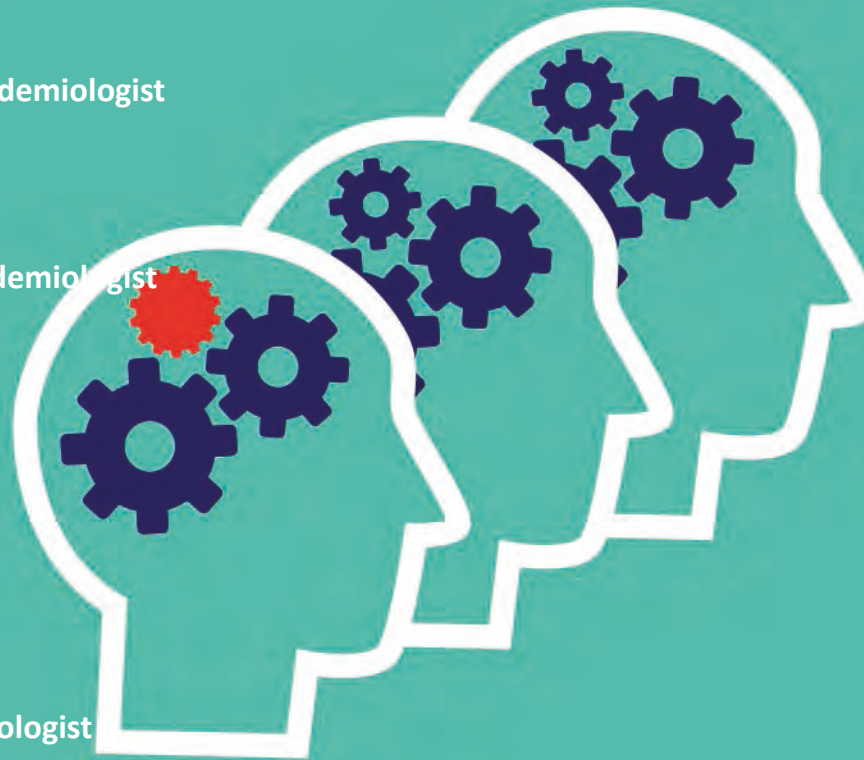
- Importance de poursuivre l'étude des possibilités de réversibilité de la fragilité
- Les interventions ciblent l'activité physique, la nutrition, l'aménagement du domicile, l'évaluation gériatrique
- La majorité portent sur une activité physique seule ou combinée
- Marginalement la cognition

## Perspectives (2)

- Deux domaines n'ont pas l'objet de RCT
  - La dimension psychosociale
    - PFFEIA study: a non-pharmacological intervention targeting the psychosocial aspects of frailty will be designed and implemented in Mexico City (Avila-Funes & Amieva, not funded)
  - Les technologies appliquées à la santé
    - OMNIHOME project (leader Georgios Meditskos, Greece) (projets soumis H2020 HORIZON 2020 - Call: Health, demographic change and wellbeing) :
    - WP : Tester un dispositif d'enregistrement et de traitement de données multimodales (analyse automatique et synchronisée d'images vidéo enregistrées par des caméras portées et de signaux d'accélérométrie) capable de reconnaître un nombre défini de situations à risque (risque de chute, oublis majeurs dans des activités de la vie courante, accidents domestiques, intrusion d'une tierce personne...). Ce dispositif sera expérimenté en population générale au sein d'une cohorte en population générale afin d'en évaluer l'acceptabilité, la faisabilité à grande échelle, et l'efficacité dans une population de sujets âgés / fragiles.
- **Ces domaines ont toute leur place dans une réflexion sur la prise en charge de la fragilité, y compris en population**

Psycho-epidemiology  
of aging and chronic diseases

Prof H Amieva; Neuropsychologist  
Dr S Auriacombe; Neurologist  
Dr JA Avila-Funes; Geriatrician, Epidemiologist  
Dr V Bergua; Psychologist  
Dr C Blanchard; Psychiatrist  
Prof J Bouisson; Psychologist  
M Carlsberg; PhD student  
Prof JF Dartigues; Neurologist, Epidemiologist  
Dr A Edjolo; Epidemiologist  
Dr A Foubert-Samier; Neurologist  
Dr M Koleck; Psychologist  
Dr L Letenneur; Epidemiologist  
C Meillon; Biostatistician  
Dr C Ouvrard; Psychologist  
Dr K Pérès; Epidemiologist  
S Ranjeva; PhD student  
N Raoux; Psychologist  
Prof N Rasclé; Psychologist  
Dr S Schroyen; Psychologist  
Dr M Tabue ; Geriatrician, Epidemiologist  
R Villeneuve; PhD student  
A Zamudio-Rodriguez; PhD student



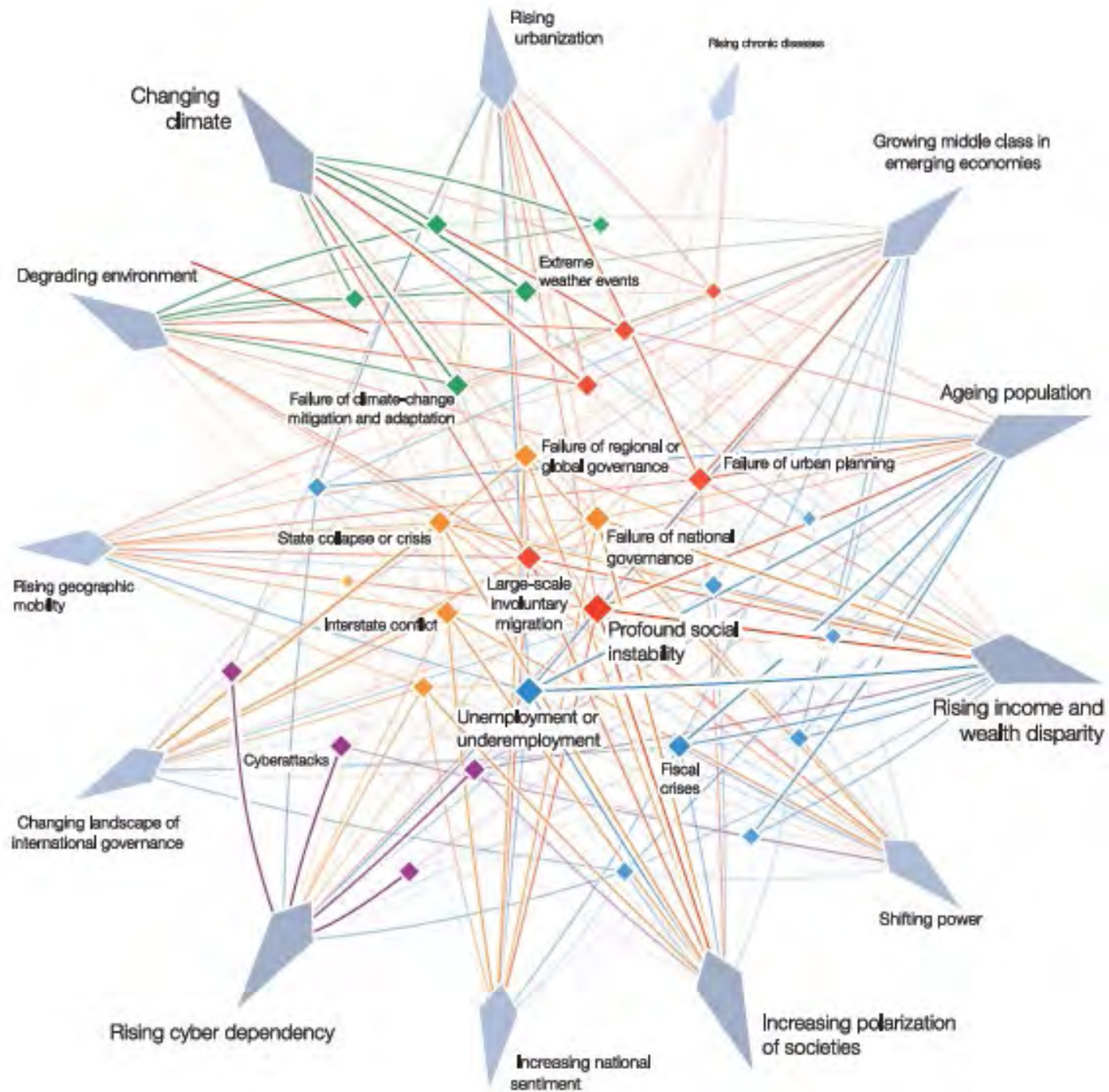
# Aging and innovation opportunities and challenges

Luis Miguel Gutiérrez Robledo

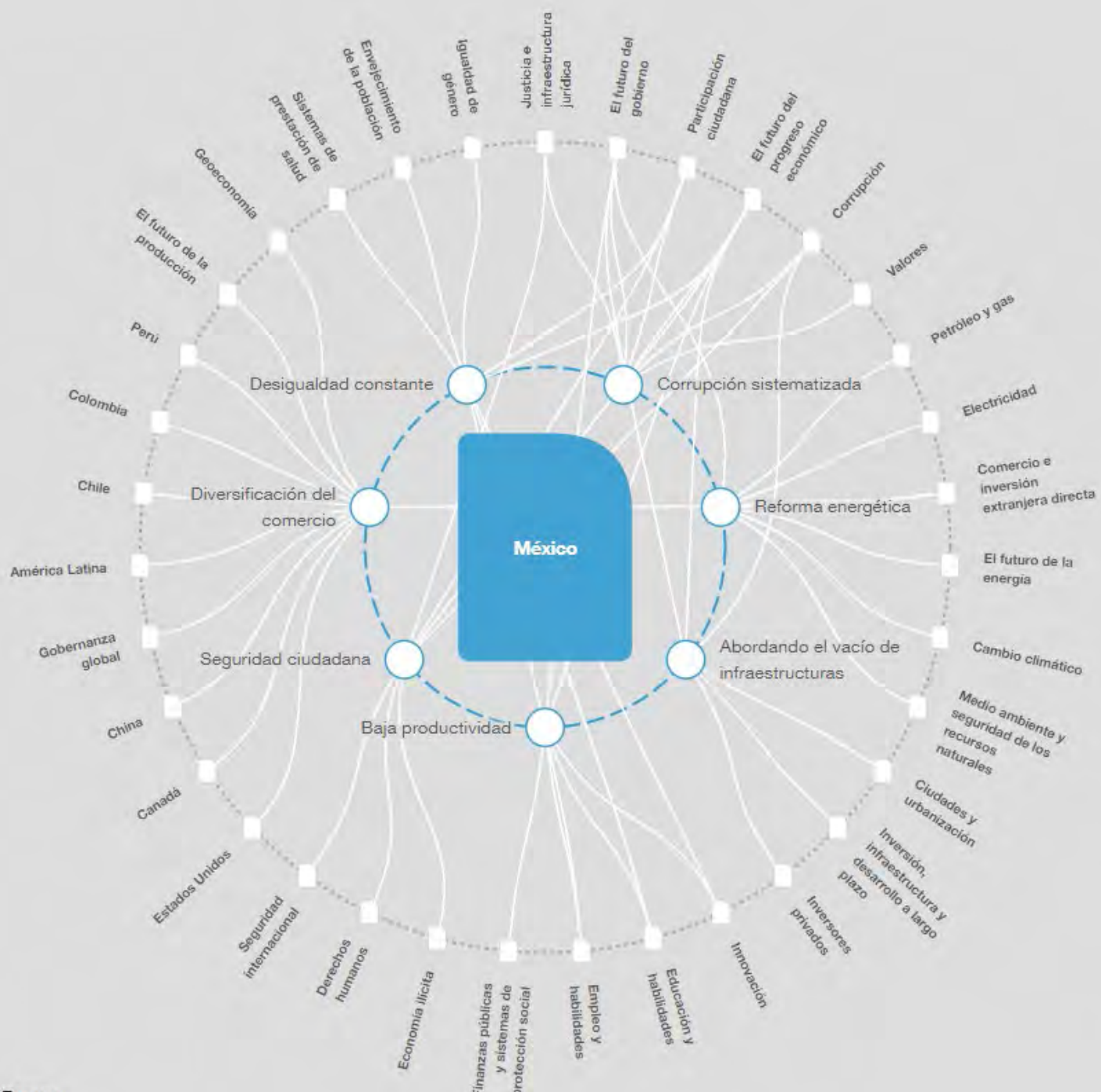


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Conocimiento y conciencia  
para un envejecimiento saludable





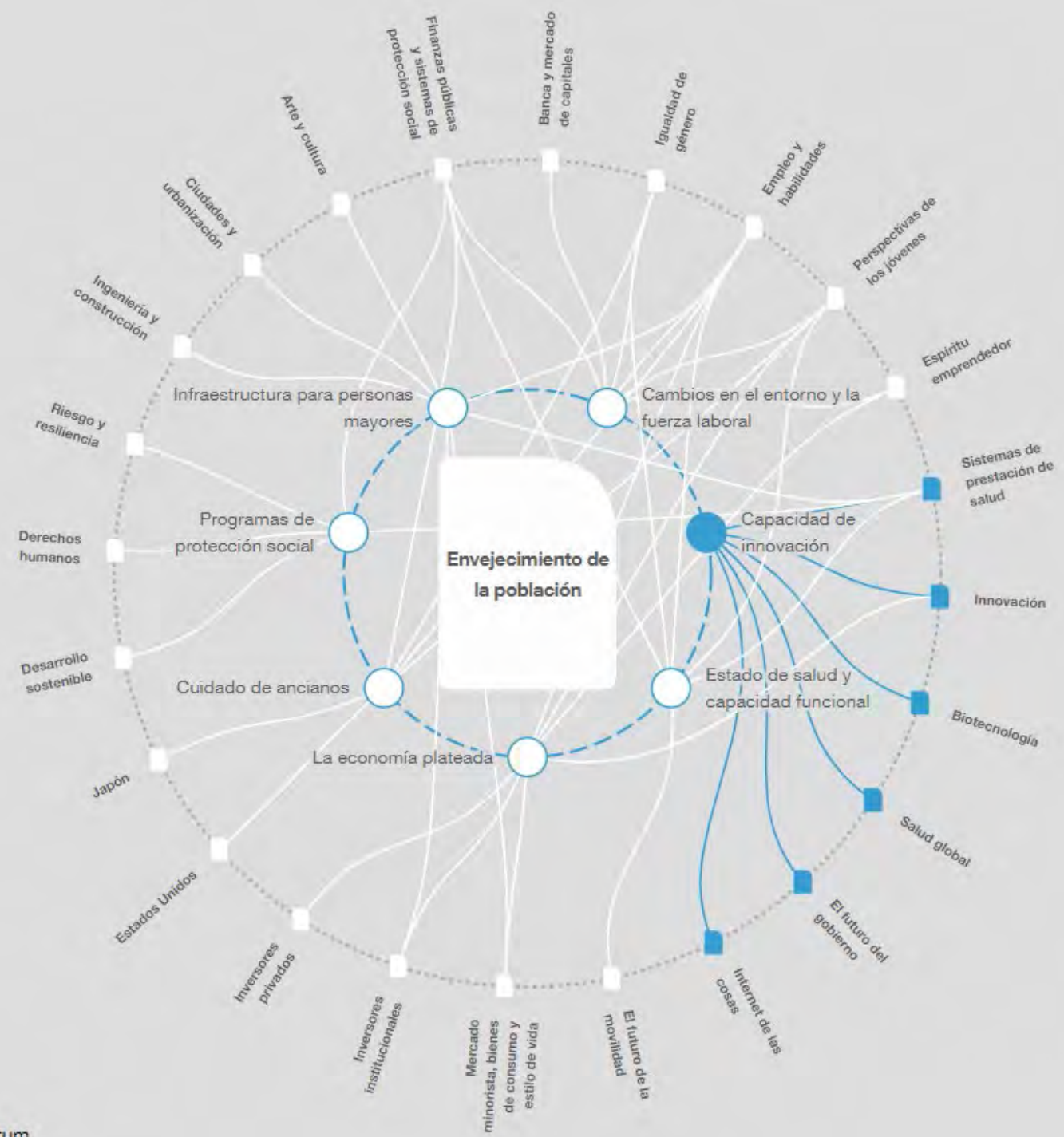


# TEN COMANDMENTS FOR HEALTHY AGING

- 1** In **35 years**, mexicans older than 65 will go from **7 to 20%** of total population.  
In Mexico today live more older adults (>60) (12.7 millions) tan children (<5) (10.2 millions).
- 2** **Demographic change** opens new opportunities for progress in Health Policy.
- 3** Because of the public Health Policy progress in the region, we have a great chance to promote **healthy aging of latin americans**.
- 4** **20%** of older adults in región become frail and up to **10%** become totally dependent.
- 5** Healthy old people are **less costly** tan middle aged people.
- 6** The challenge is not old age but disease. **Universal Health coverage is a must.**
- 7** **Geroscience** will improve our chances to prevent disease, prolong healthspan and prevent dependence.
- 8** The development of a new person **centered and personalized model of care** and training of the ad hoc professionals is a priority.
- 9** **The Strategy and Action Plan on Aging and Health** focus on research, human rессources development, a new model of care and comprehensive public policy development to face the challenge of population aging.
- 10** With a succesful strategy and action plan for healthy aging we can envision a **decade of healthy ageing following.**











# The Aging Readiness & Competitiveness Report

Home

Pillars +

Countries +

UPDATED FOR 2018

**KEY**

- Leader
- Mover
- Laggard



12 countries

61 % of the Global Economy

47 % of the Global 65+ Population

- Community Social Infrastructure
- Productive Opportunity
- Technological Engagement
- Healthcare & Wellness



# 10 of the mayor transformations facing the future of aging:





- **Home care:** new solutions that make it easier for people to stay in their homes longer and allow the provision of care at home.
- **Virtual health:** from telehealth to remote monitoring, the digital health revolution makes it possible to care anywhere.
- **Consumerism:** the empowered patient and the growing demand for information, access and control of the consumer is changing the market.
- **Price transparency:** the ability to understand and compare prices is changing the dynamics of medical care at all levels.
- **Data release:** layers of interoperability and connectivity are changing the way providers, family and caregivers interact.
- **Platforms for caregivers:** markets are training patients, families and caregivers to create better care, and reduce costs.
- **Design:** an emphasis on personalized design and ease of use for all is simplifying and skipping the care of aging in an elegant way.
- **Vitality:** a focus on well-being and lifestyle is changing the focus of health from just treatment to prevention and living well.
  - **Longevity:** an understanding that we are living longer and healthier lives. 90 is the new 65?.
- **Market focus:** a neglected area of innovation, but entrepreneurs, innovators and investors are reconsidering the whole aging care market.

## Mobile app for self-assessment of frailty

Porto4Ageing, a Reference Site and partner of the European Innovation Partnership on Active and Healthy Ageing, has updated the mobile app which enables you to check how frail you are. The app is now available in English, Portuguese and Italian.



### About mHealth

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[Reports and studies](#)

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### Related topics

[eHealth](#)

The app, named [FrailSurvey](#), is based on the Groningen Frailty Index and was developed to help community-dwelling senior citizens. It assesses diverse sides of life, namely your mobility, physical shape, vision, hearing, nutrition, as well as cognitive and psychosocial aspects. The app classifies the user as 'robust', 'pre-frail' or 'frail'. When the older adult is classified as 'pre-frail' or 'frail' some recommendations are available.

Knowing your frailty status is important for healthy ageing, as it can help to change your lifestyle to prevent or revert a certain frailty status. The mobile app is free of charge and available for IOS and Android operating systems.



**INNOVATING  
FOR AGEING**

## ILC-UK and Just Group announce shortlisted entries for Innovating for Ageing competition

Oct 18, 2018 | [NEWS](#)

The International Longevity Centre UK and [Just Group](#) have announced the shortlisted entrants of the Innovating for Ageing competition, which aims to identify solutions to address the challenges faced by vulnerable consumers in later life.



# Innovation for Active & Healthy Ageing



# LONGEVITY INDUSTRY LANDSCAPE OVERVIEW 2017

Volume I: The Science of Longevity

Geroscience, Policy, and Economics

The Paradigm Shift: from Treatment to Prevention



OPPORTUNITIES  
FOR PARTNERSHIP



# Top 10 Lists

## Top 10 Longevity Scientists

				
Michael West	Dr. Felipe Sierra	Cynthia Kenyon	Aubrey de Grey	
				
Joao Pedro de Magalhaeres	David Sinclair	Nir Barzilai	George Church	Brian Kennedy

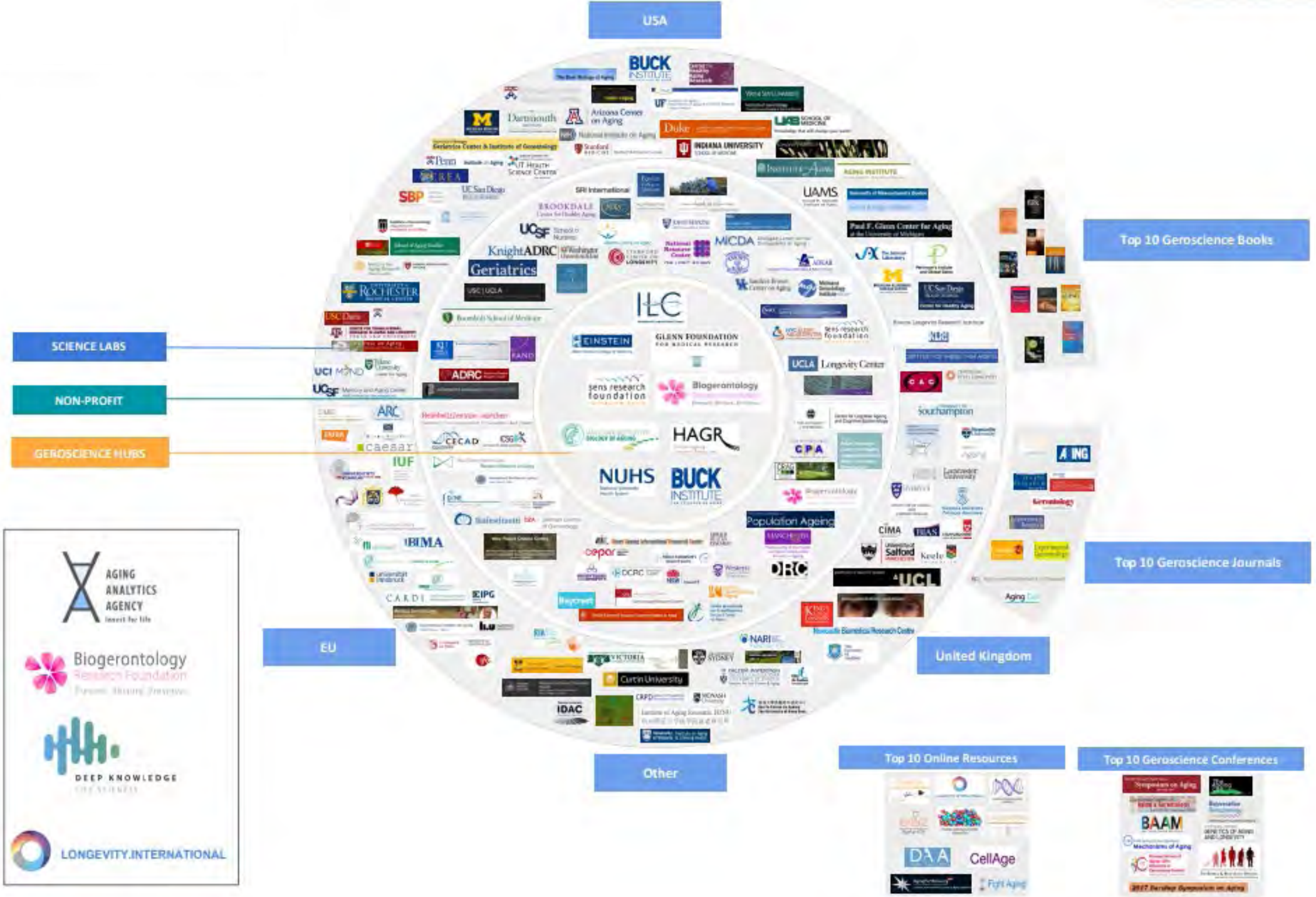
## Top Longevity Investors

					
Dmitry Kaminskiy	Jeff Bezos	Peter Thiel	Jim Mellon	Bryan Johnson	Finian Tan

## Top Longevity Influencers

		
Larry Page	Sergey Brin	Ray Kurzweil
		
Martine Rothblatt	Larry Ellison	Nathaniel David
		
Bill Maris	J. Craig Venter	Alex Zhavoronkov





USA

Top 10 Geroscience Books

SCIENCE LABS

NON-PROFIT

GEROSCIENCE HUBS

EU

United Kingdom

Top 10 Geroscience Journals

Other

Top 10 Online Resources

Top 10 Geroscience Conferences

AGING ANALYTICS AGENCY  
Invest for life

Biogerontology Research Foundation  
Pursuing Missing Connections

DEEP KNOWLEDGE OF SCIENCES

LONGEVITY INTERNATIONAL

Top 10 Online Resources

DAA CellAge

Fight Aging

Top 10 Geroscience Conferences

BAAM

2017 Research Symposium on Aging



# Technological Innovations for Health and Wealth for an Ageing Global Population

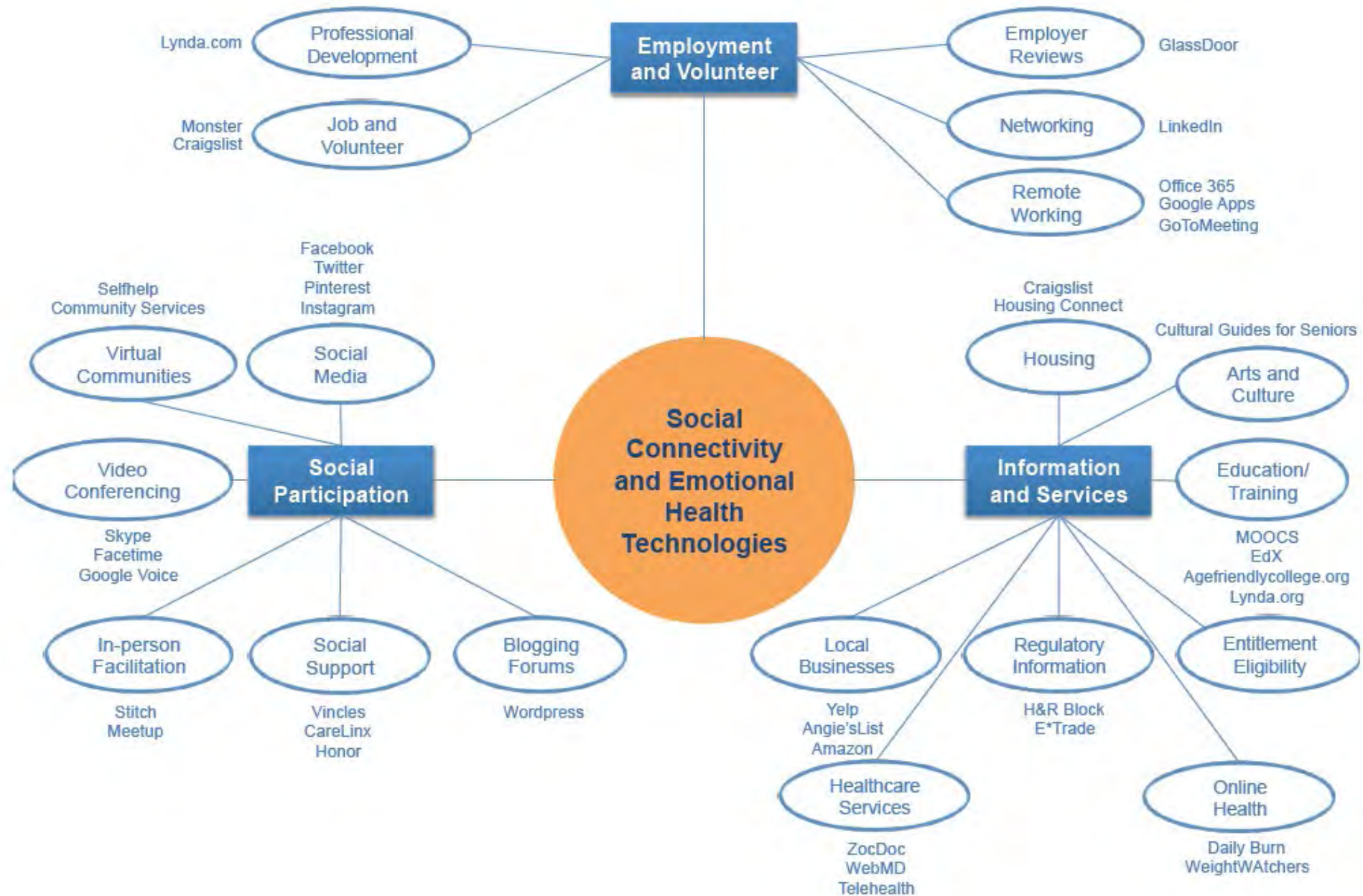
Technology Focus Area	Impact on Healthy Ageing
Social connectivity and emotional health	Sense of purpose, meaning in life, emotional contact and overall mental well-being
Cognitive ability	Mental well-being (anxiety, depression), alcohol intake, nutrition and medication adherence
Physical ability	Mobility, musculoskeletal disorders and mental well-being (dementia, cognitive decline)

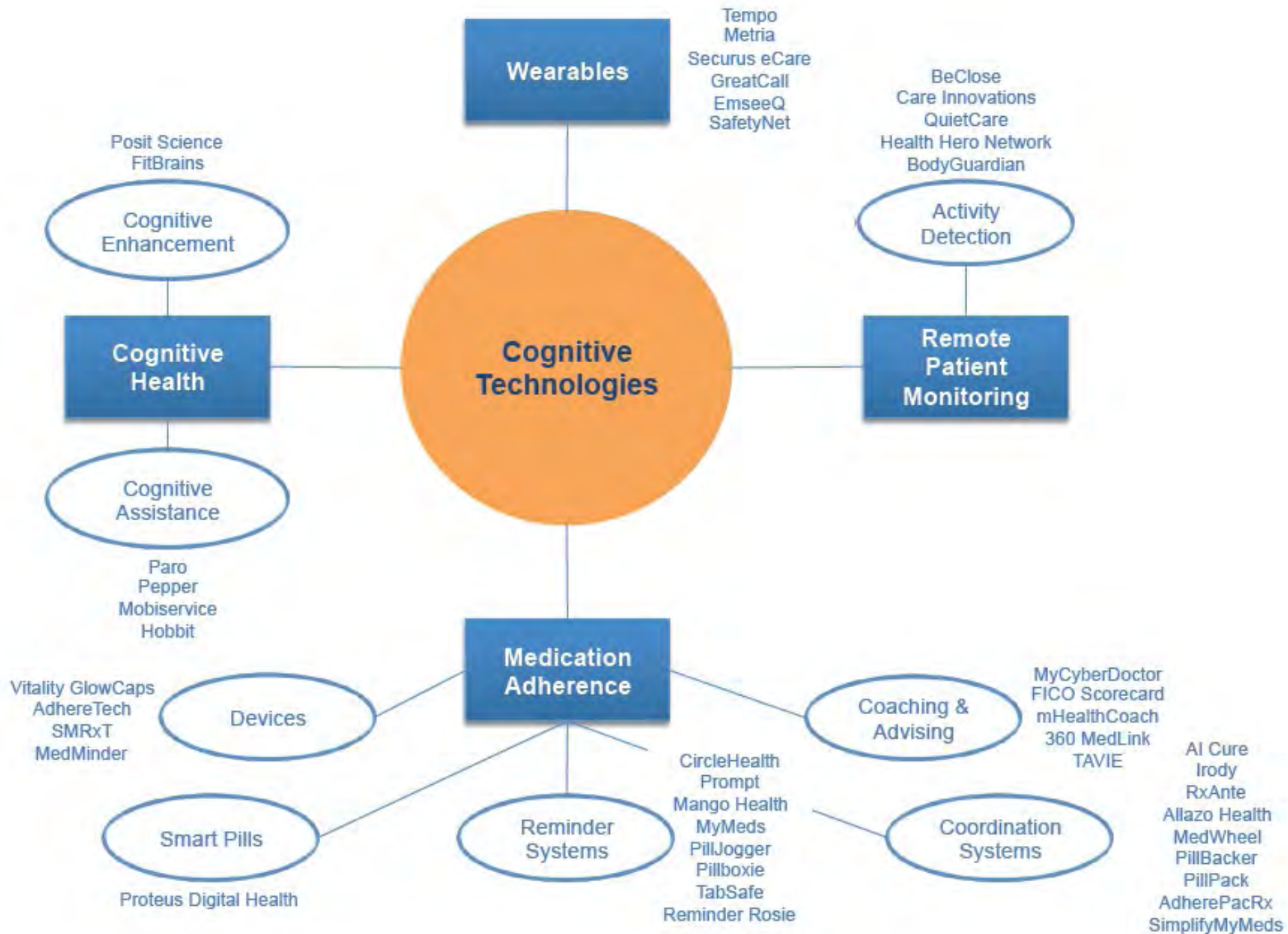


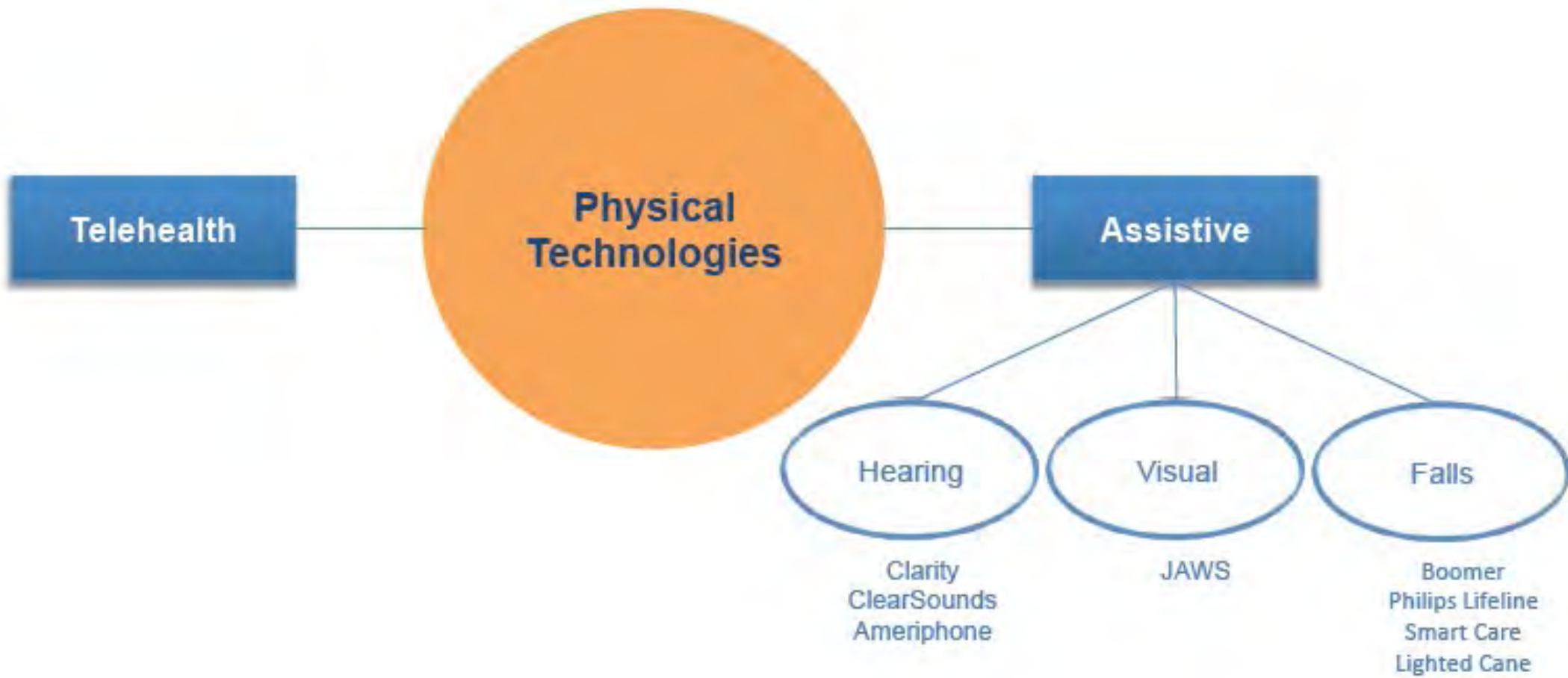
\* OECD et al. (2015). Promoting Active Ageing in the Digital Economy: Inclusion, Adaptation and Innovation.  
Available at: [http://www.oecd.org/sti/ieconomy/OECD\\_GCOA%20Report%202015.pdf](http://www.oecd.org/sti/ieconomy/OECD_GCOA%20Report%202015.pdf).



# Landscape of Healthy Ageing Technologies for Older Adults

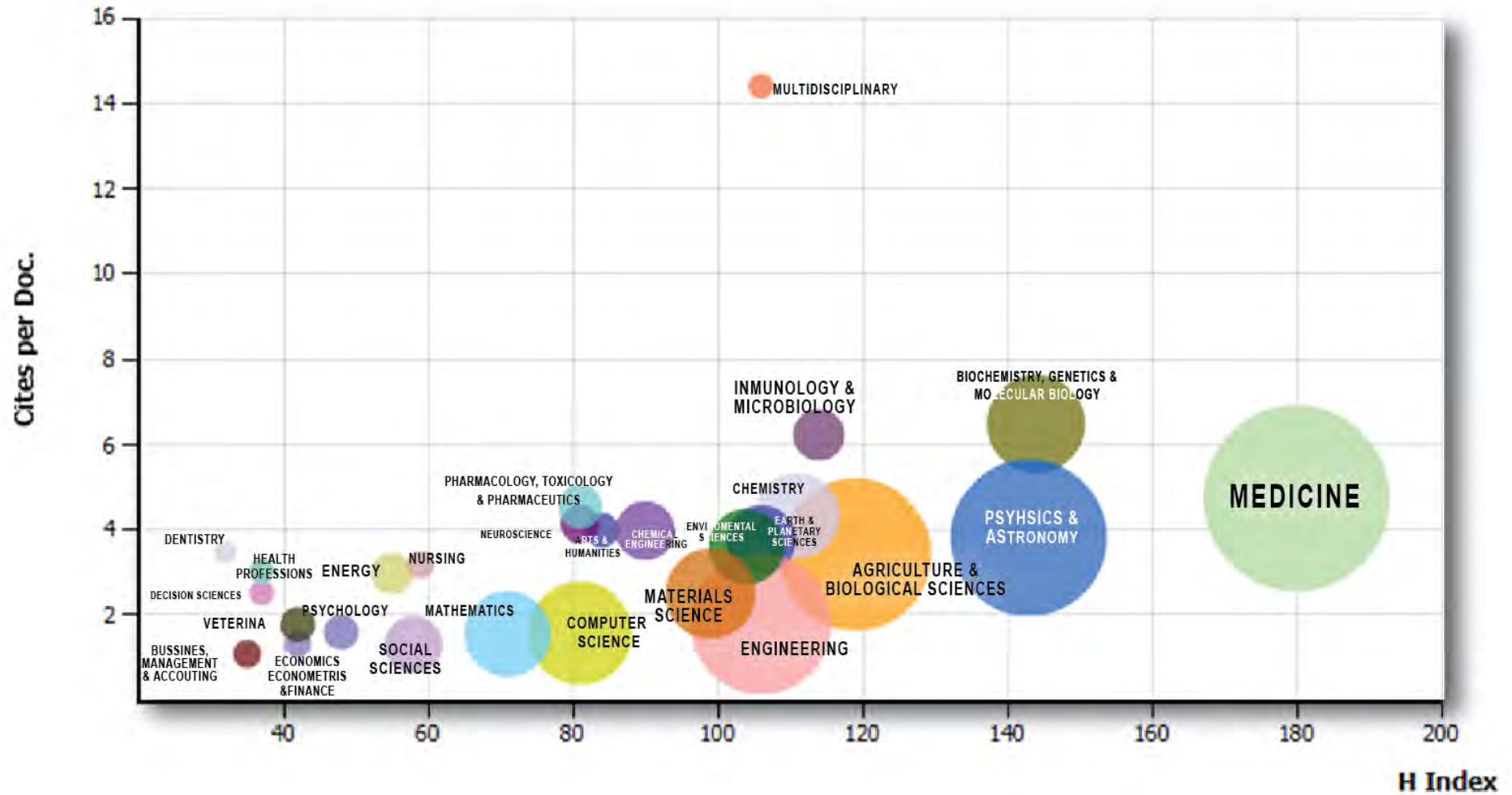


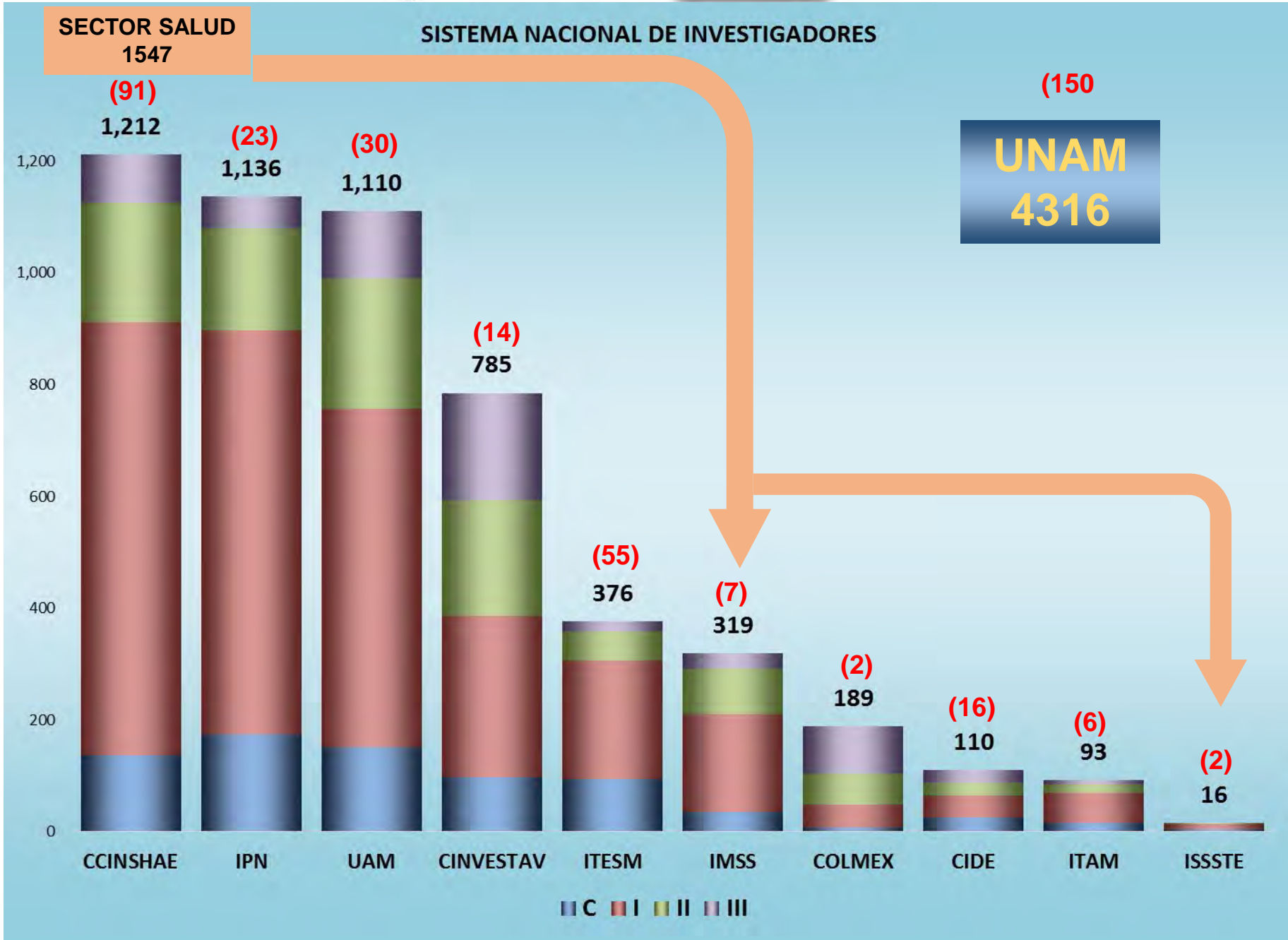




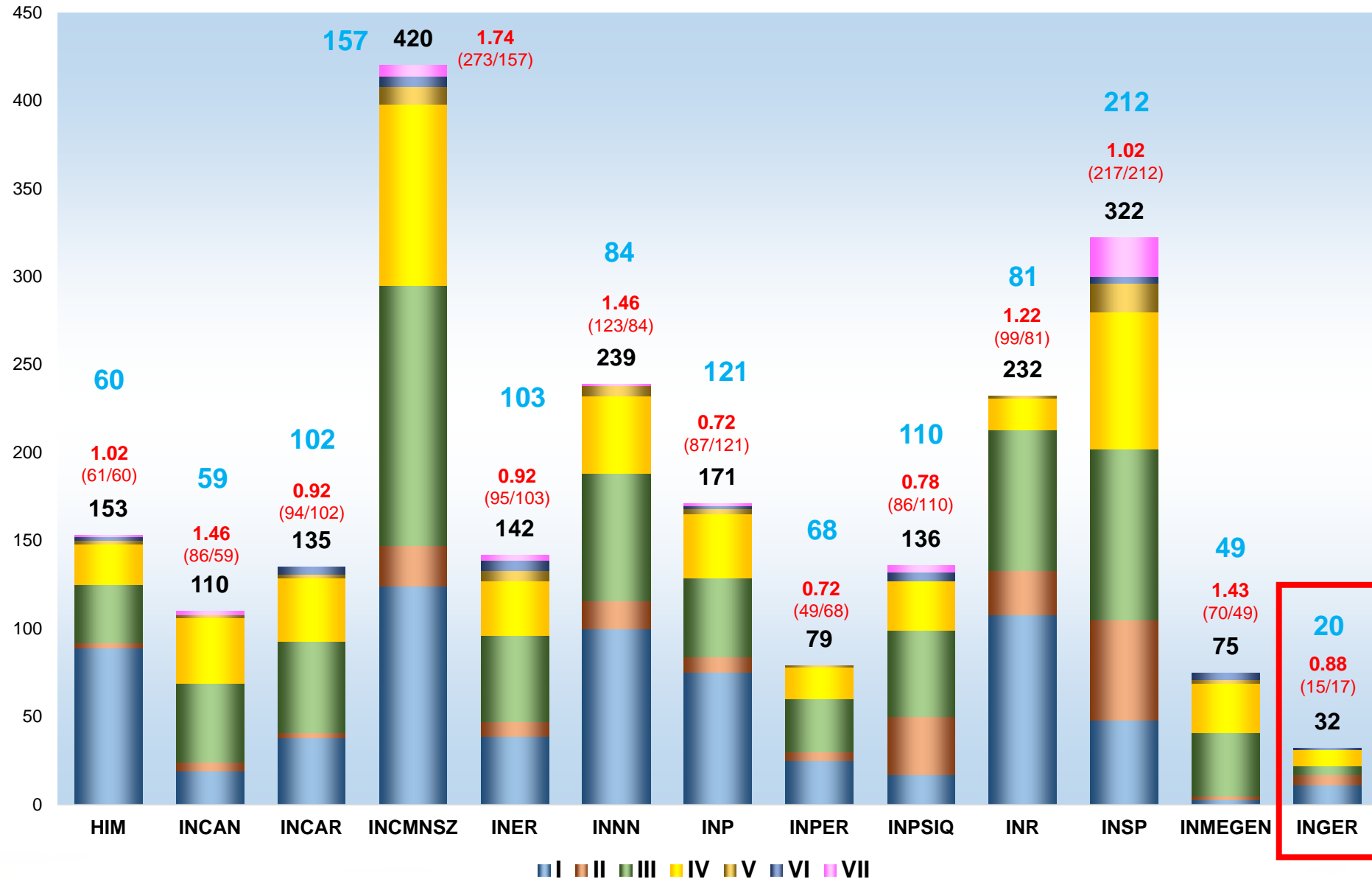


## Índice H por áreas del conocimiento México 2012-2013



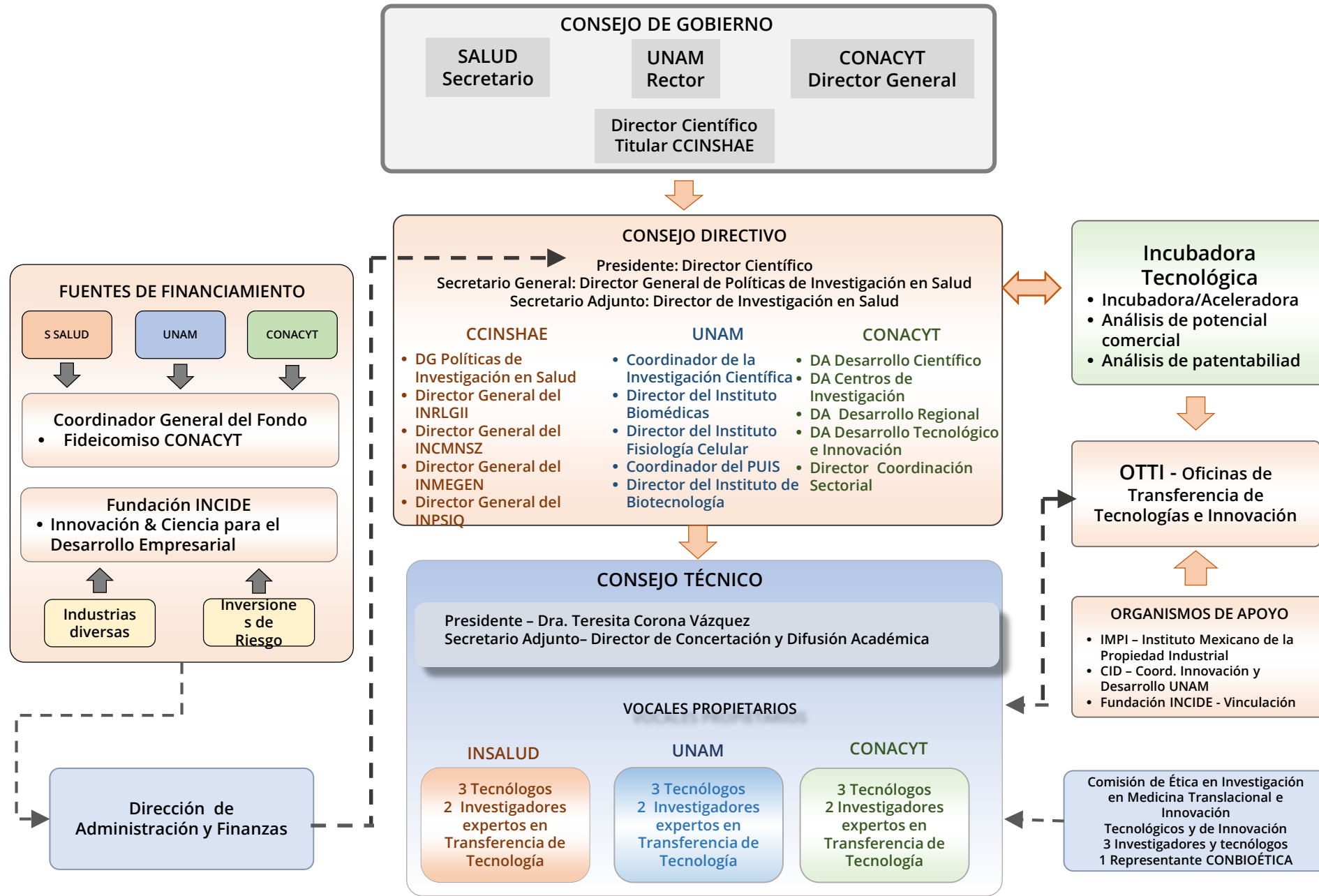


## INSalud Publicaciones e Índice de Impacto (III-VII / SII Vigentes) 2015



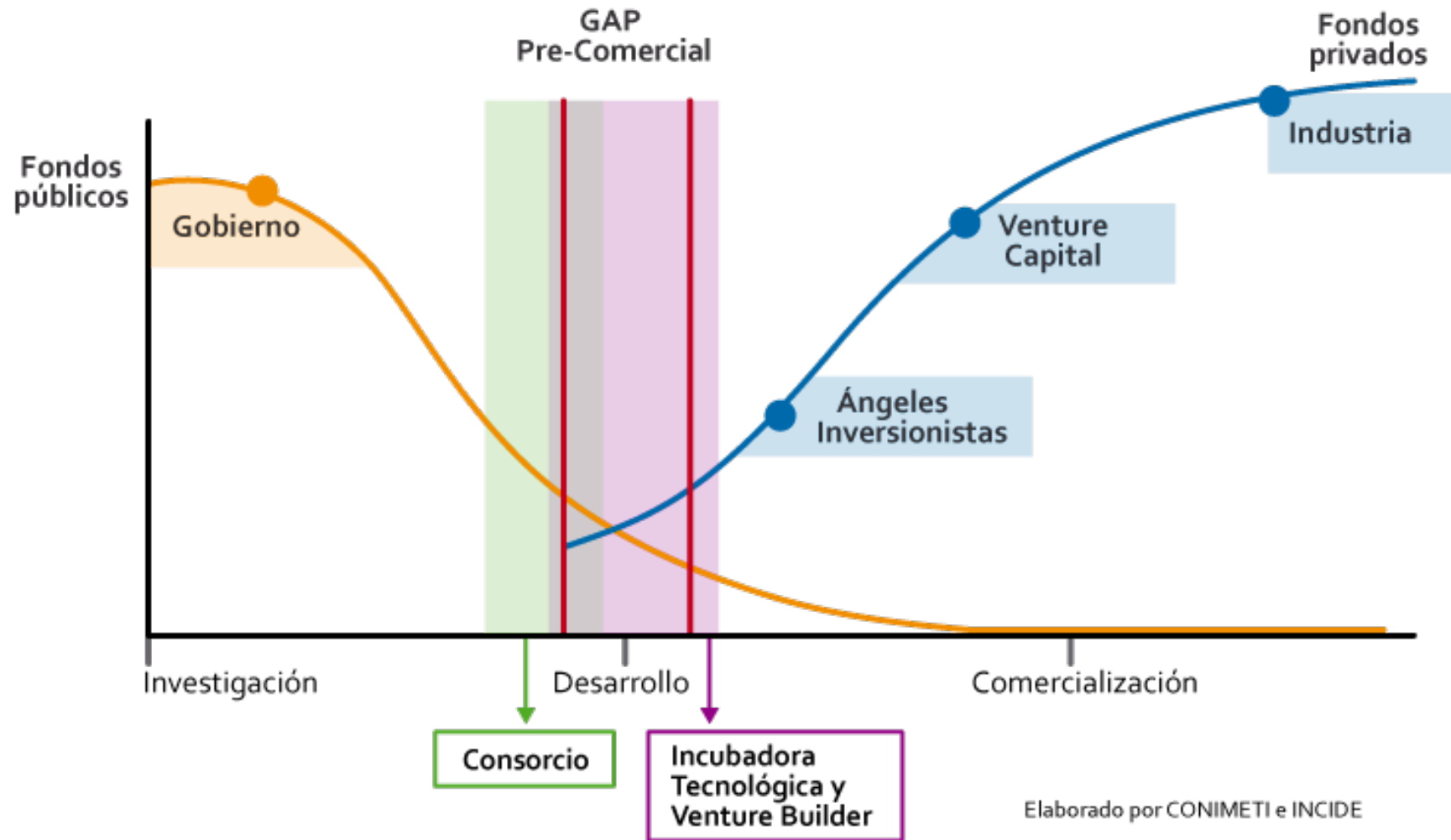


# Consortio Nacional de Investigación en Medicina Traslacional e Innovación



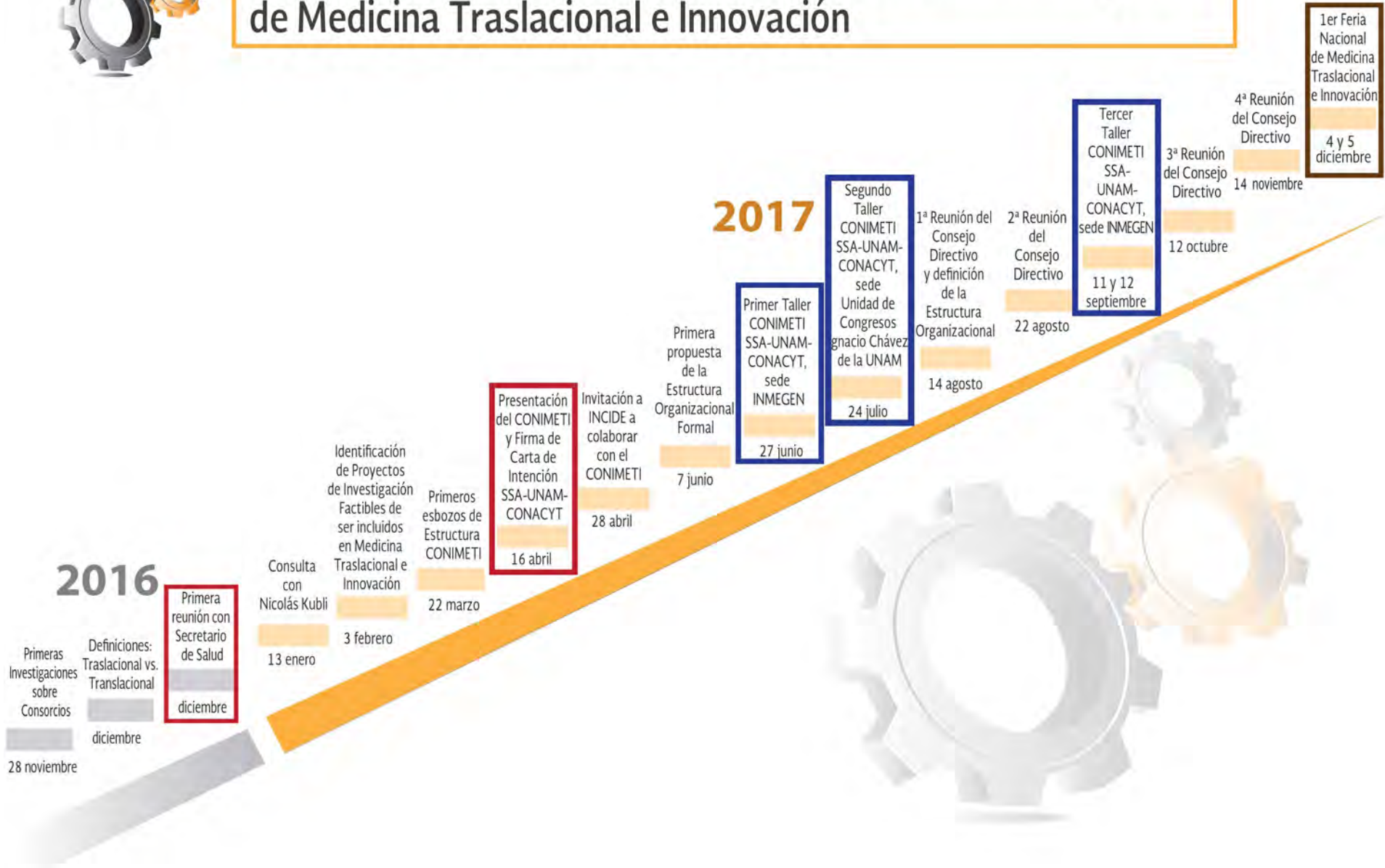
# INCUBADORA TECNOLÓGICA & VENTURE BUILDER

## Propuesta de INCIDE y CONIMETI





# Creación y Evolución del Consorcio Nacional de Investigación de Medicina Traslacional e Innovación



# 1ª Feria Nacional de Investigación en Medicina Traslacional e Innovación

## 9ª Jornada Nacional de Innovación y Competitividad

4 de Diciembre 2017

Hotel Fiesta Americana Reforma



**2<sup>nda</sup>**  
**FENIMETII**  
FERIA NACIONAL DE INVESTIGACIÓN EN MEDICINA TRASLACIONAL E INNOVACIÓN

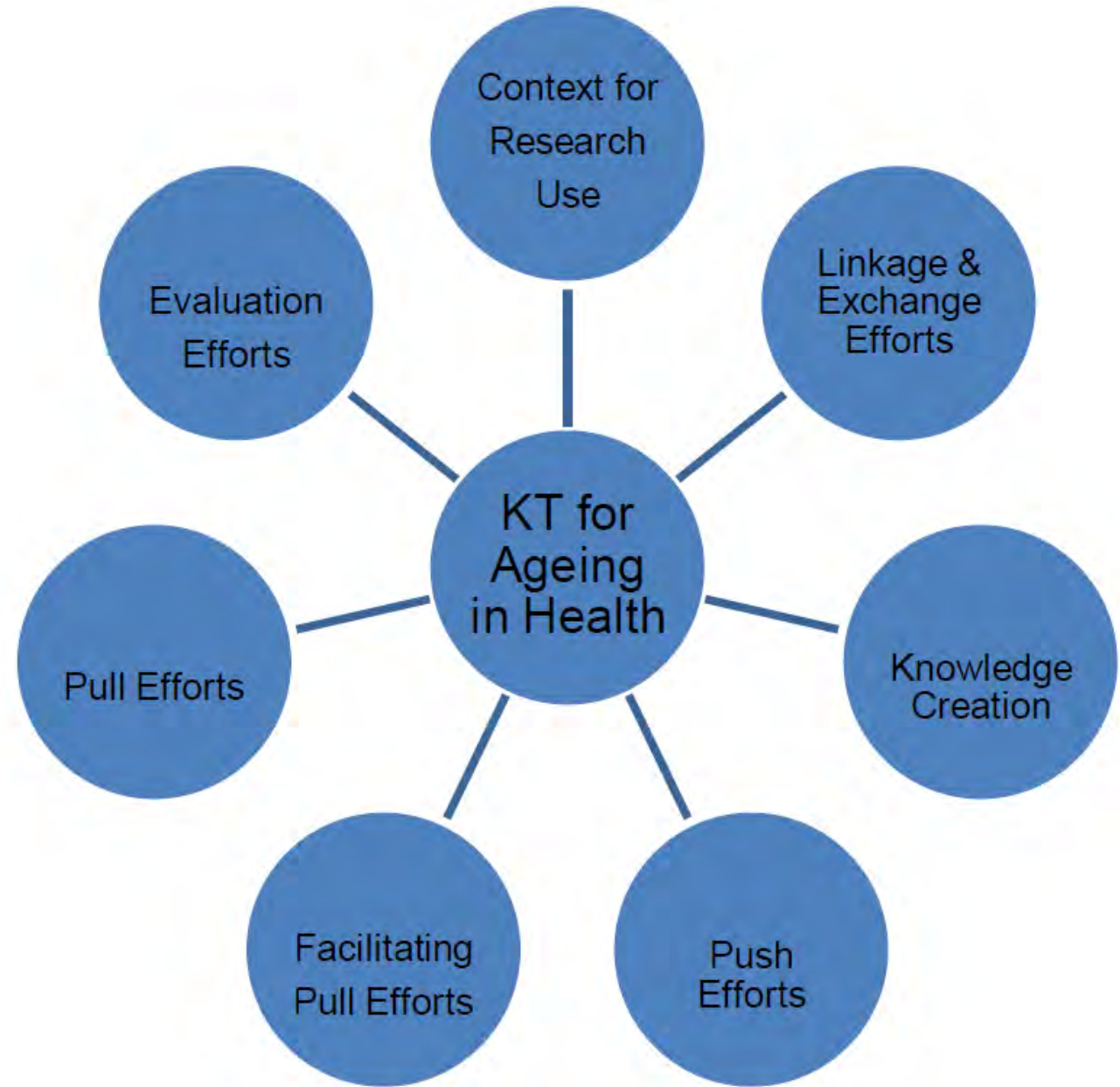
**FERIA NACIONAL DE INVESTIGACIÓN EN MEDICINA TRASLACIONAL E INNOVACIÓN**  
EL NUEVO CAMINO PARA LA CIENCIA  
**5 Y 6 DE NOVIEMBRE DE 2018**  
Ciudad de México

- Medicina Traslacional • Salud • Innovación
- Conferencias magistrales • Vinculación
- Talleres • Emprendimiento
- Sesiones de Pitch y Pósters
- Desarrollo Tecnológico

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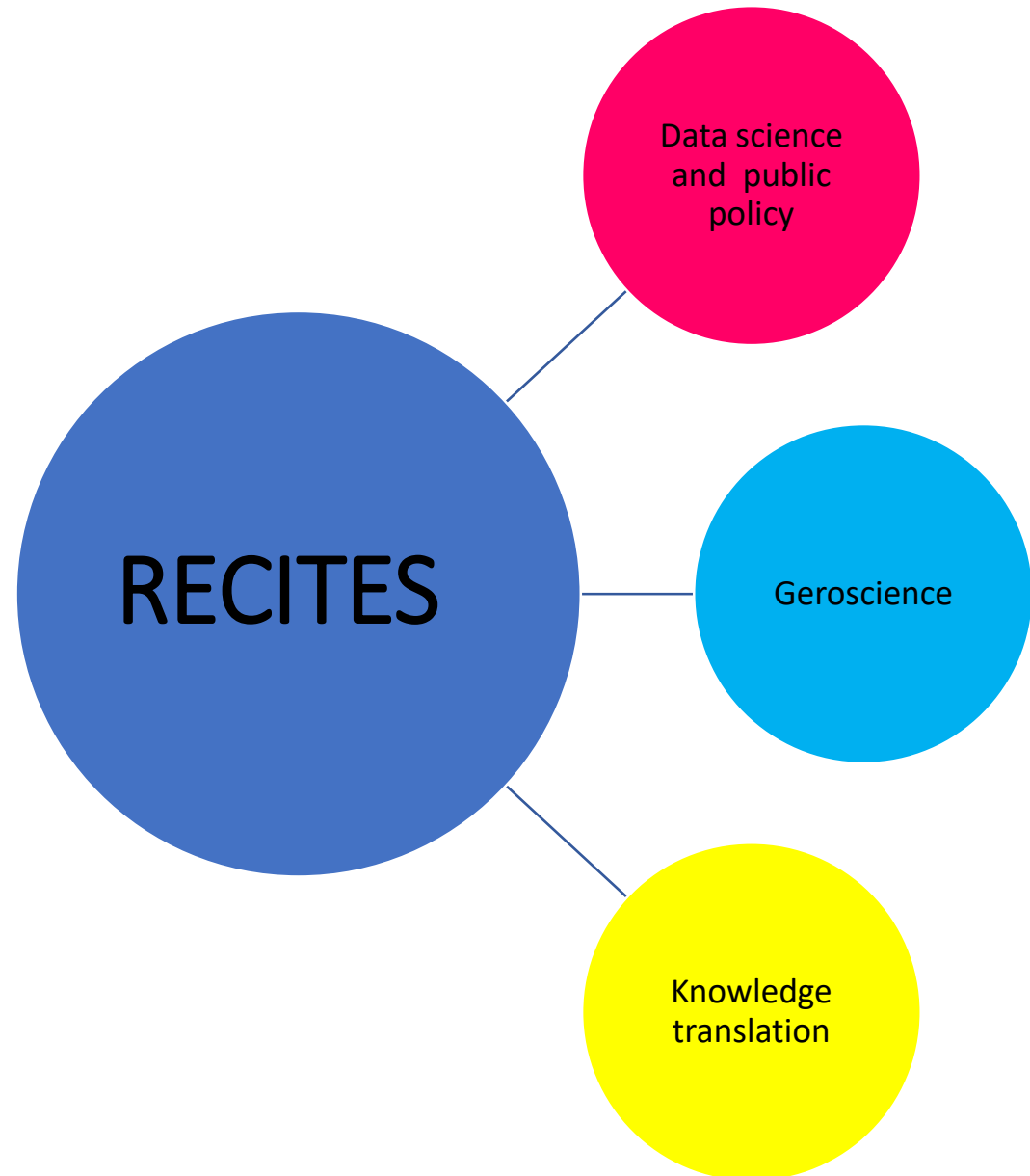
# Ciencia traslacional



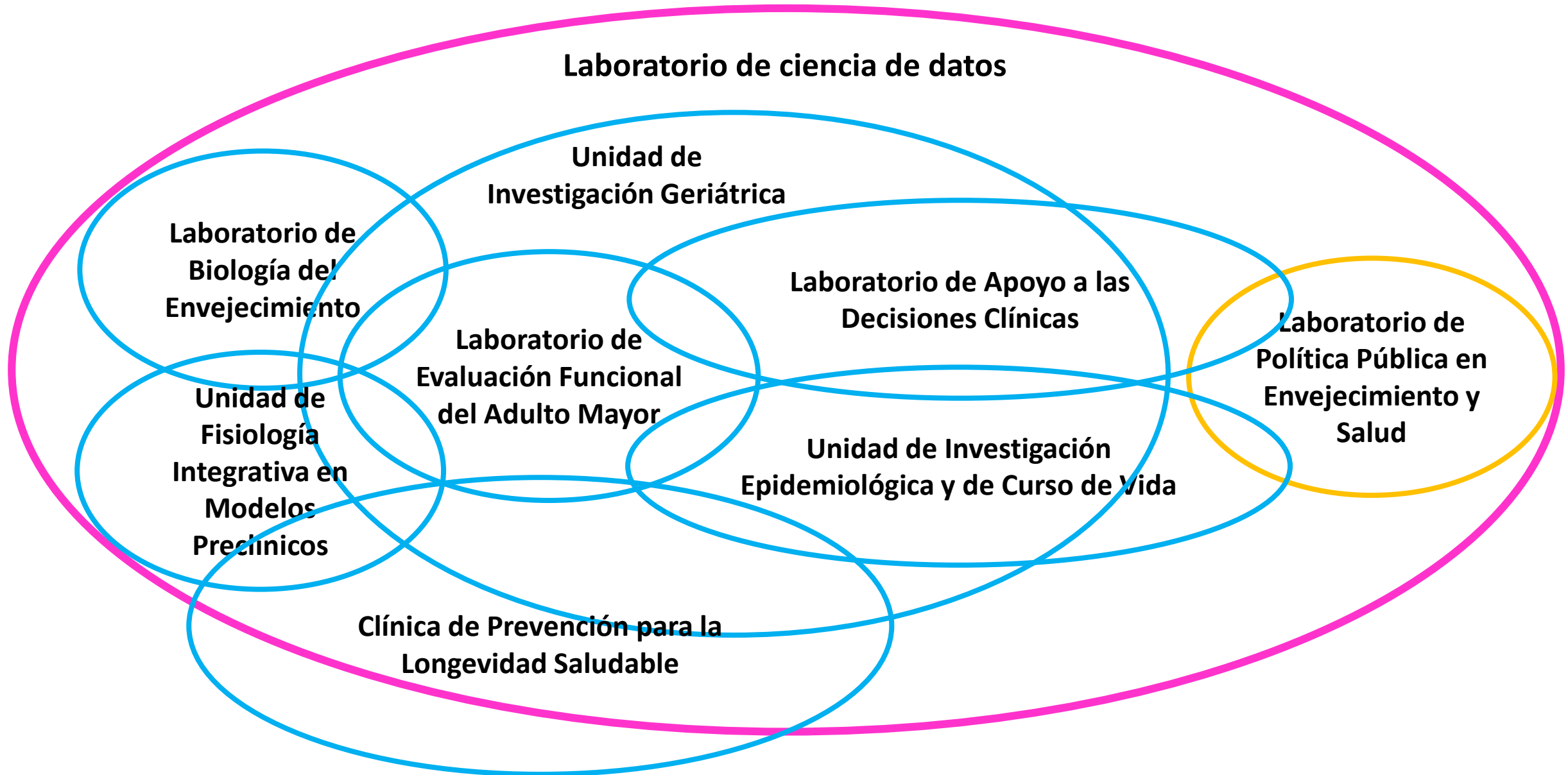


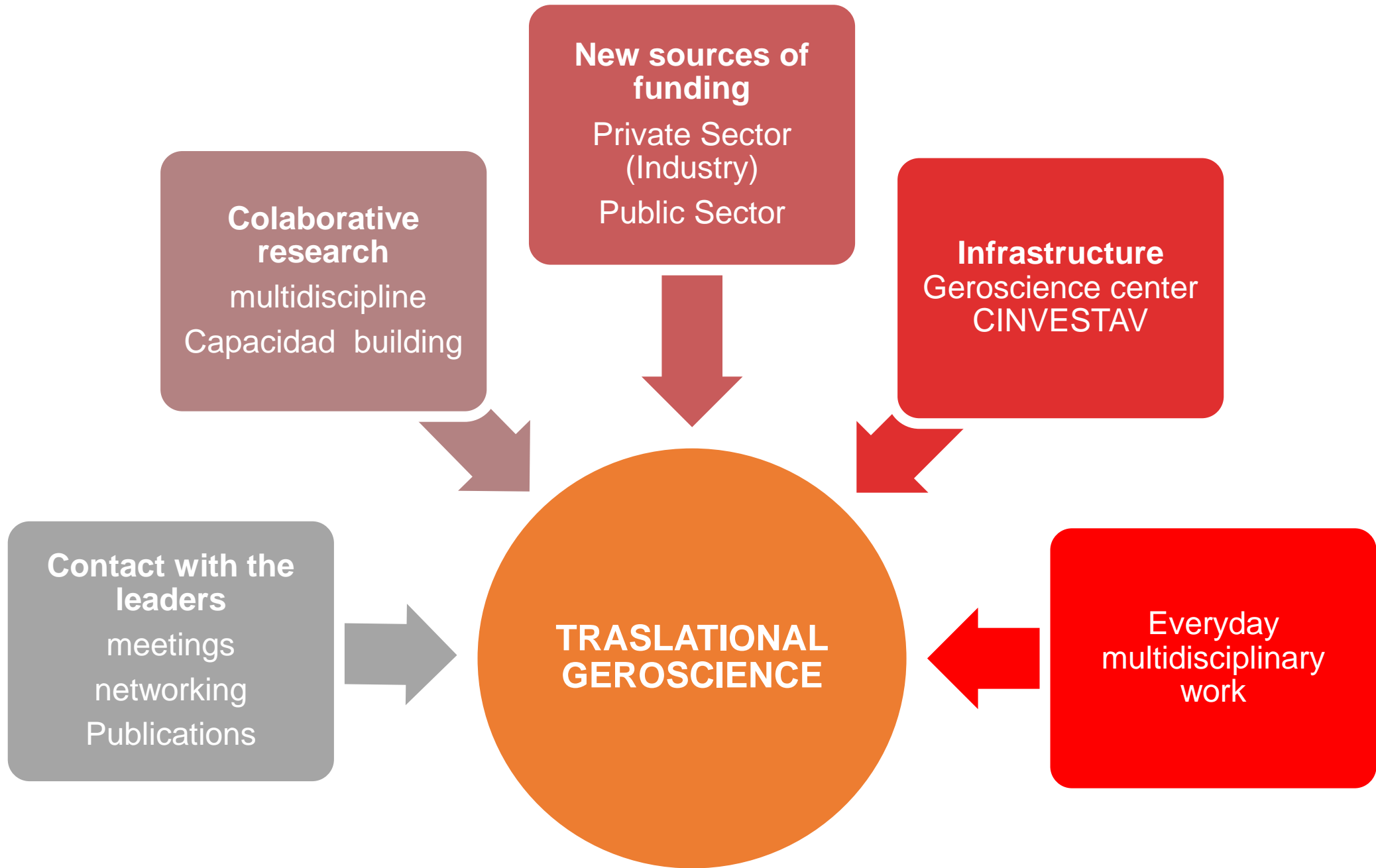
Contribute to understanding the biology of aging, its relationship with health and disease as we age, as well as its influences and impacts on society and the health system.

Transdisciplinary collaboration in research to address aging from a multidimensional perspective and in an articulated manner between basic and clinical researchers, social scientists and decision makers in order to develop interventions and strategies that increase the healthy life expectancy of the inhabitants at CDMX.



# Gerociencia traslacional en el INGER





# The main functions of Mexico's Institute of Geriatrics are:

- ❖ To foster education and training on aging.
- ❖ To develop and promote research on aging.
- ❖ To assist the Ministry of Health in the design and implementation of specific health programs.
- ❖ To act as a national reference agency concerning issues related to the subject of aging.
- ❖ To publish and disseminate studies and research on aging.
- ❖ To foster exchange between scientists on both the domestic and international arena.

**Dirección general,  
Subdirección de administración y  
Subdirección de planeación y vinculación**

**Luis Miguel Francisco  
Gutiérrez Robledo**  
Director General

**Erika Plata Córdoba**  
Subdirectora de Administración

**Elizabeth Caro López**  
Subdirectora de Planeación y Vinculación



**INSTITUTO  
NACIONAL  
DE GERIATRÍA**

Conocimiento y conciencia  
para un envejecimiento saludable

# Nuestra estructura y personal operativo

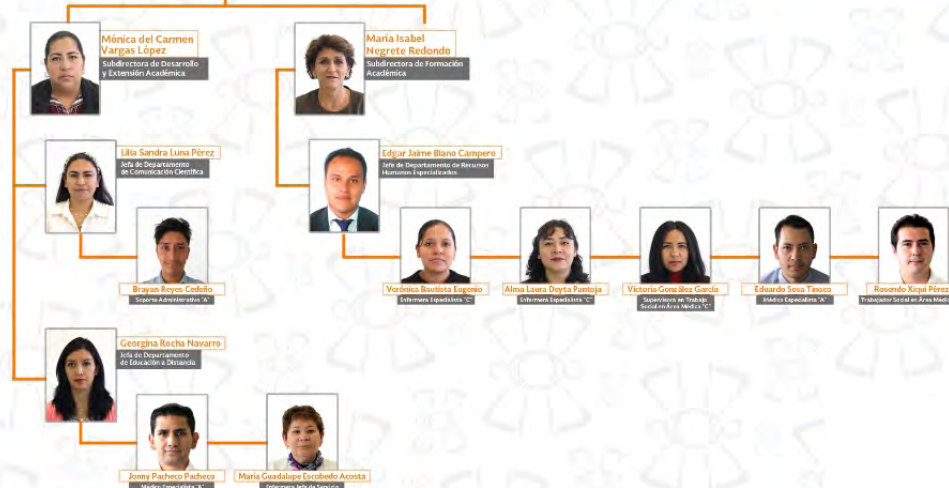
## Dirección de investigación

**María del Carmen  
García Peña**  
Directora de Investigación



## Dirección de enseñanza y divulgación

**Arturo Ávila Avila**  
Director de Enseñanza y Divulgación







Mexican Aging and Health Research Network Roadmap



Université de Sherbrooke



RÉSEAU QUÉBÉCOIS DE RECHERCHE SUR LE VIEILLESSEMENT

CENTER FOR RESEARCH ON AGING

USC

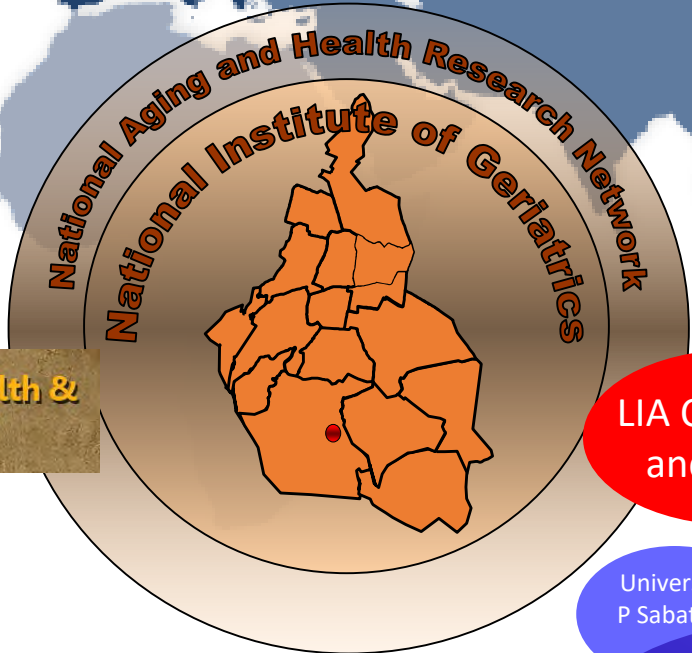
Royball Institute on Aging



Sealy Center on Aging



ALMA-PAHO



red envejecimiento y fragilidad

RETICEF

Université V. Segalen Bordeaux

ISPED



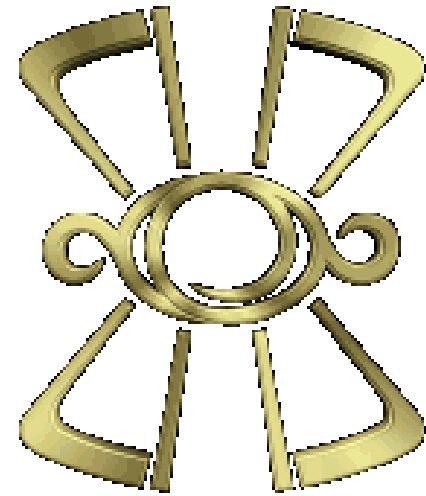
LIA Cognition and Frailty

Université P Sabatier

Gerontopôle Toulouse



Mexican Aging and Health Research Network Liaisons



Thank you.....

# PREDICCIÓN Y DETECCIÓN DE LA TOXICIDAD POR QUIMIOTERAPIA A TRAVÉS DE LA TECNOLOGÍA MÓVIL

MC Enrique Soto Pérez de Celis

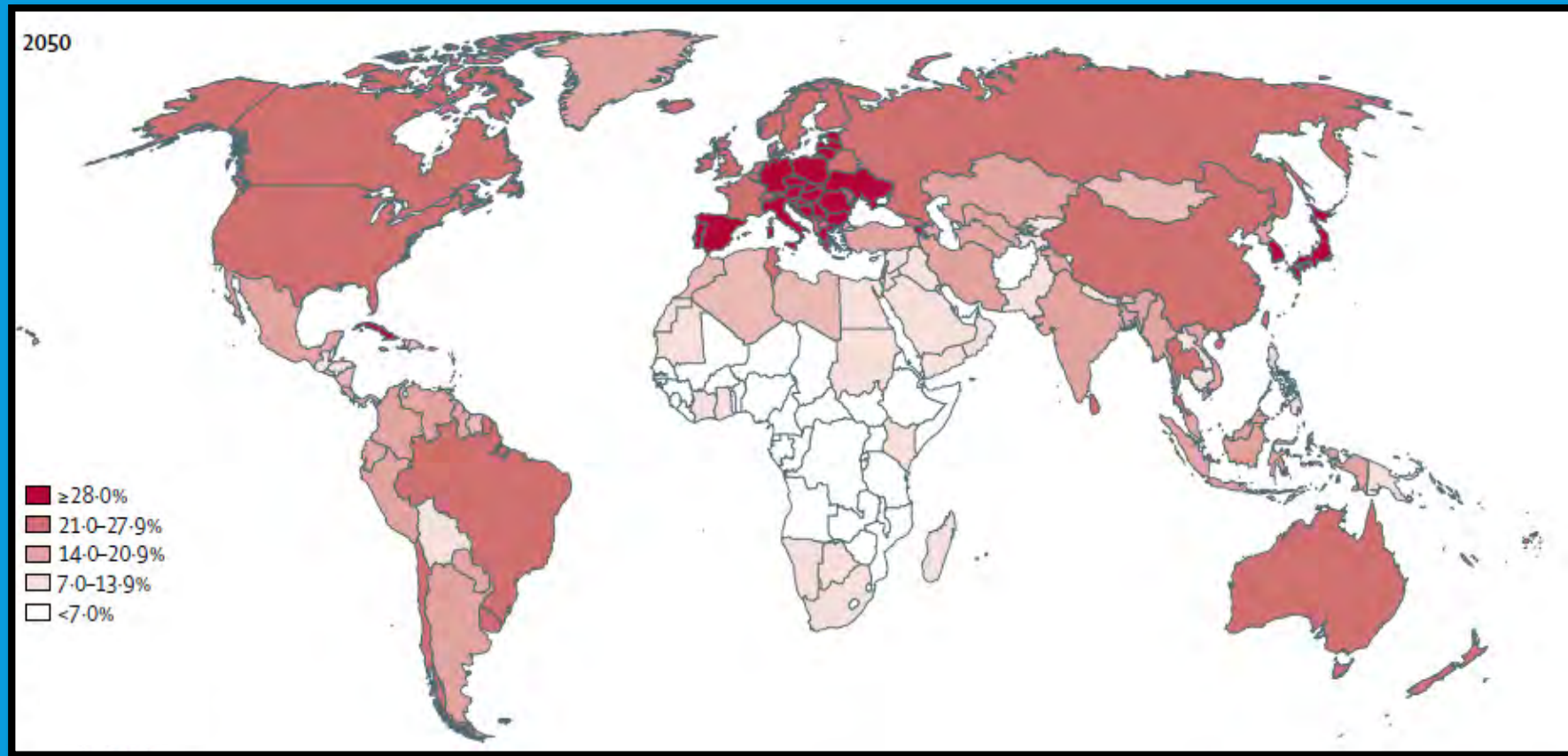
Investigador en Ciencias Médicas "C"

Servicio de Geriátrica

Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán



# EL MUNDO ESTÁ ENVEJECIENDO

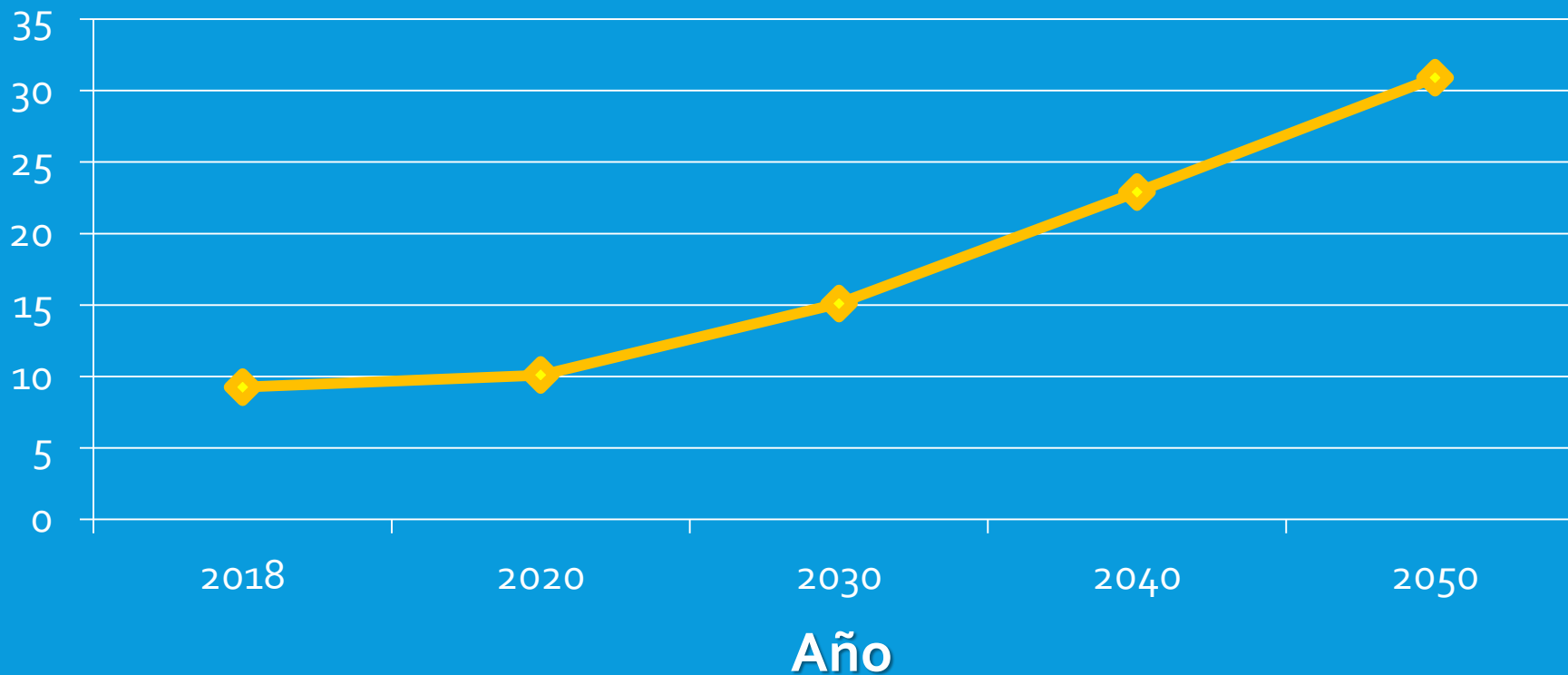




# MÉXICO ESTÁ ENVEJECIENDO

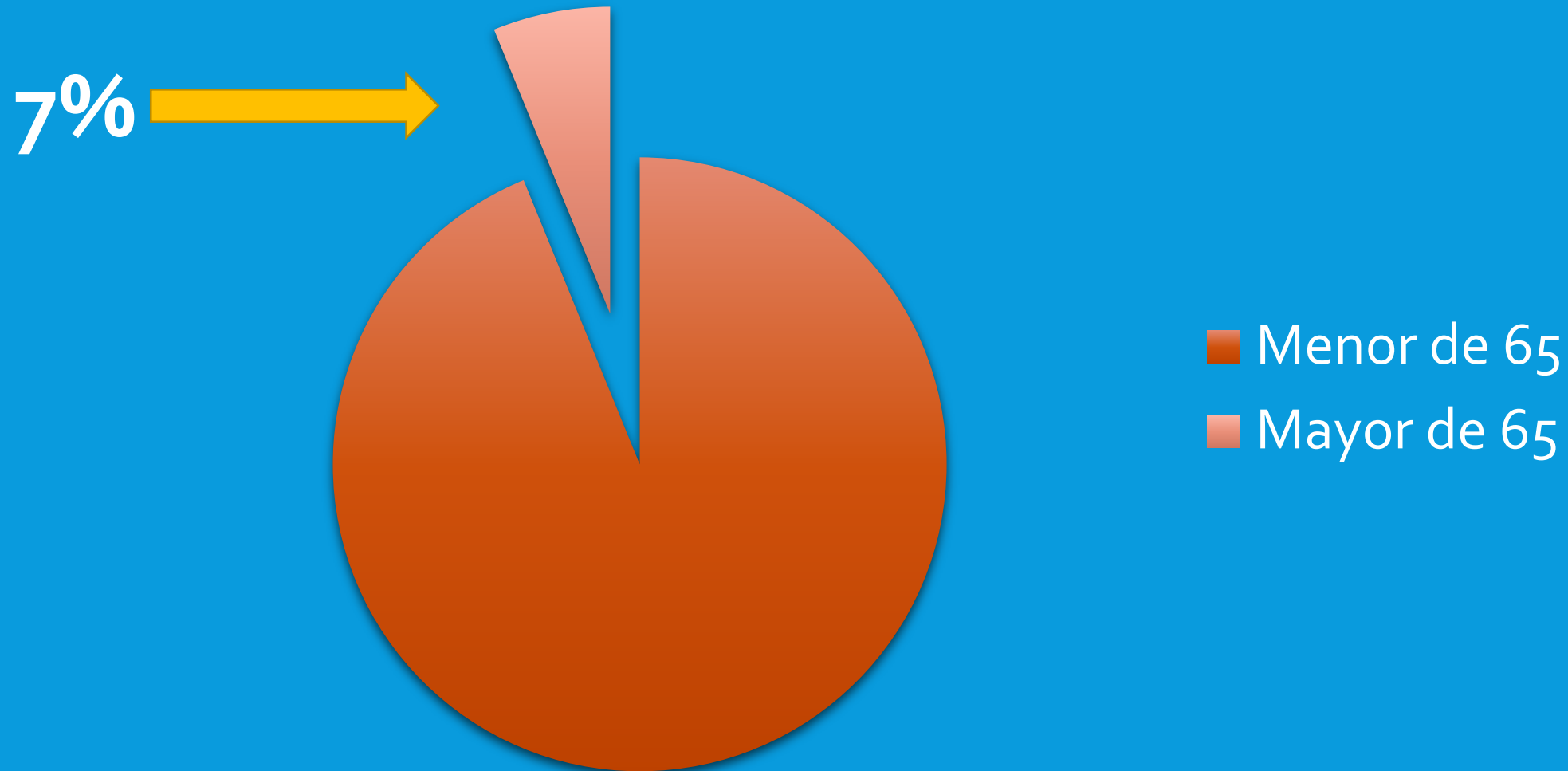
## Número de adultos mayores

Millones de habitantes



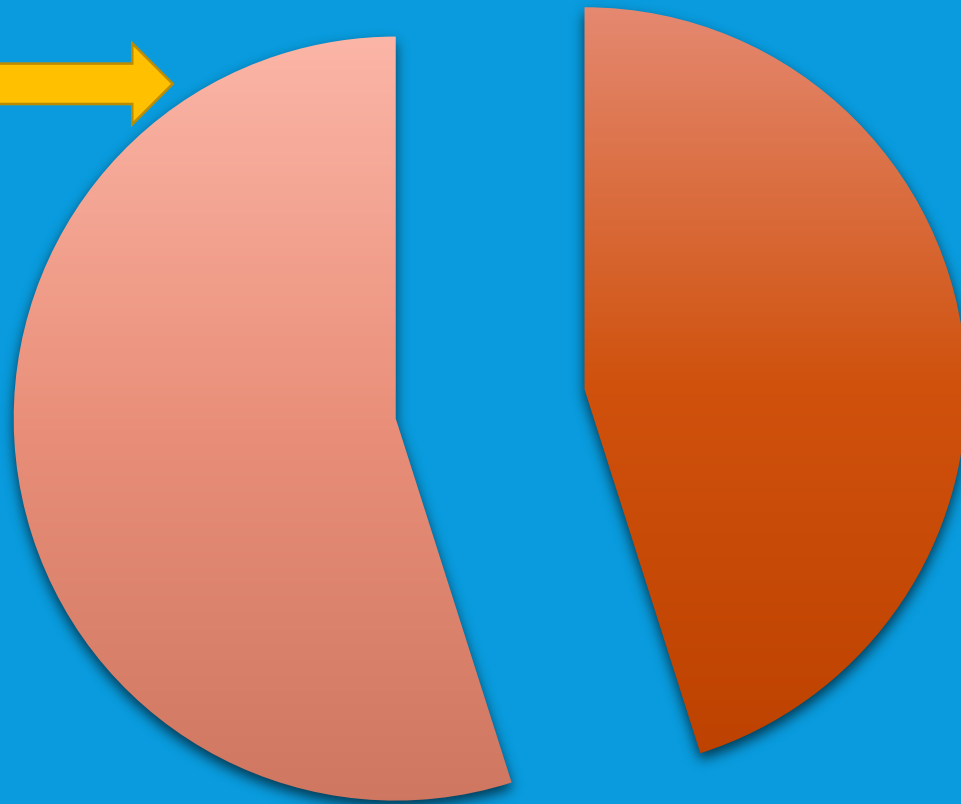
Más de 30 millones para 2050

# EL CÁNCER ES UNA ENFERMEDAD DEL ENVEJECIMIENTO



# EL CÁNCER ES UNA ENFERMEDAD DEL ENVEJECIMIENTO

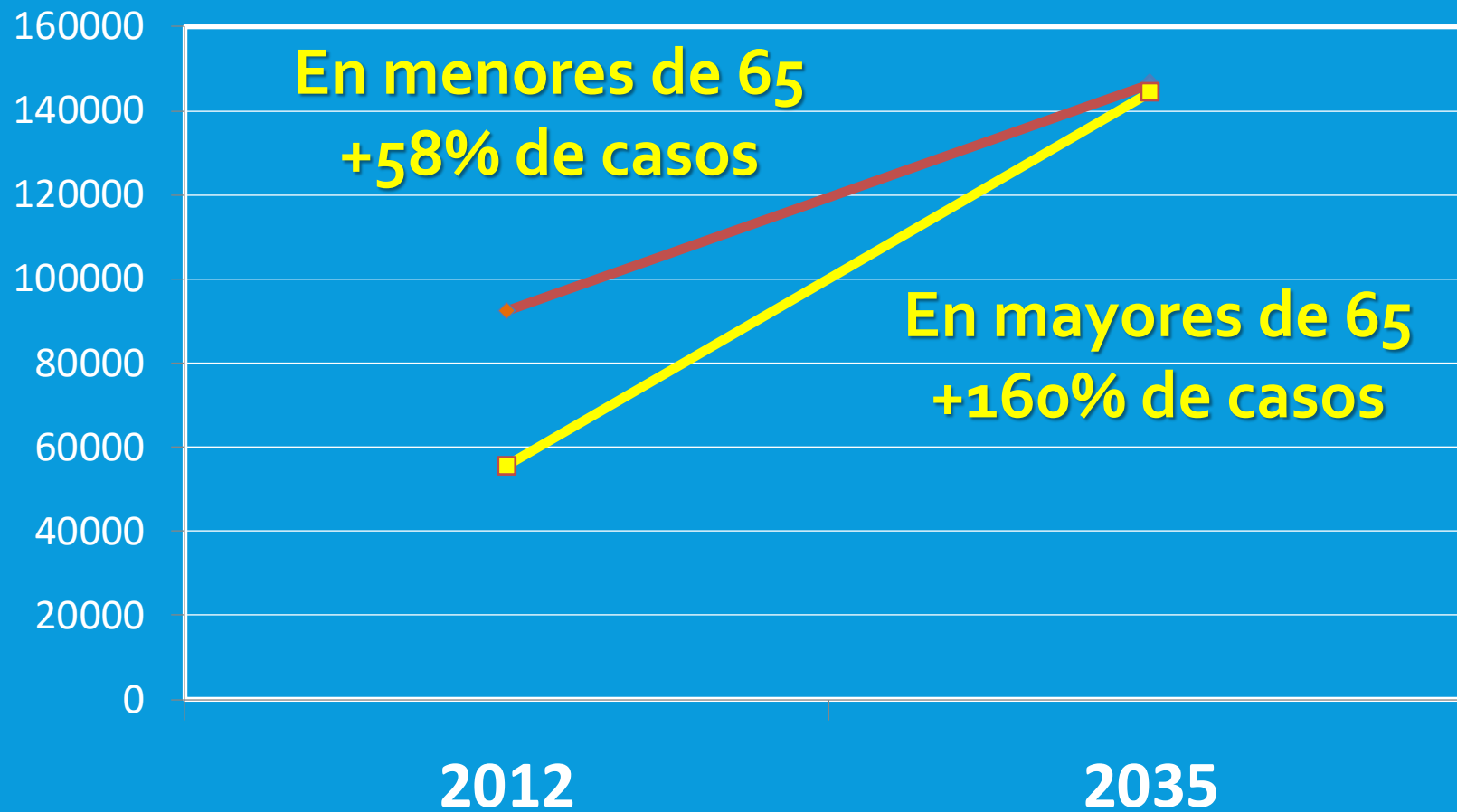
55%



- Menor de 65
- Mayor de 65

**Más de la mitad de las muertes por cáncer ocurren en el 7% de la población**

# EL CÁNCER ES UNA ENFERMEDAD DEL ENVEJECIMIENTO



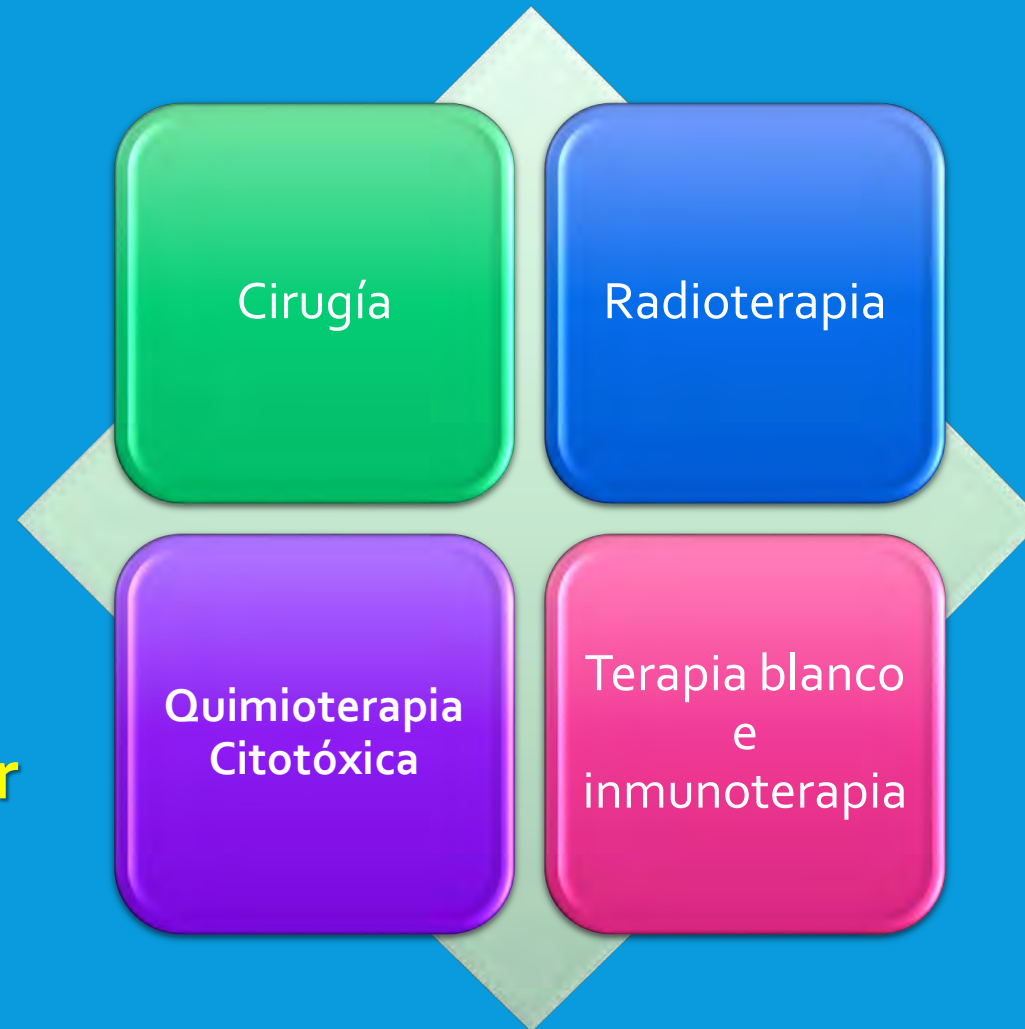
# CLÍNICA INTEGRAL DE CÁNCER EN EL ADULTO MAYOR

- Primera clínica de cáncer en adultos mayores en México
- Equipo multidisciplinario
- Objetivos
  - Identificar y resolver problemas que no se identifican normalmente
  - Ayudar al paciente a obtener el apoyo que requiere para completar el tratamiento de forma exitosa.
  - Generar proyectos colaborativos de investigación clínica en cáncer y envejecimiento





# COMPONENTES DEL TRATAMIENTO DEL CÁNCER



**La quimioterapia sigue siendo el pilar del tratamiento médico del cáncer**

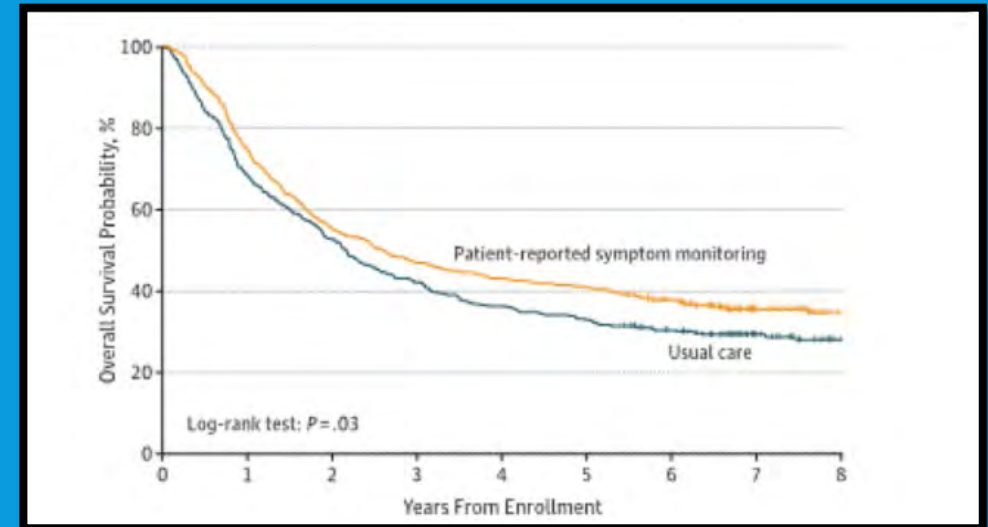
# LA QUIMIOTERAPIA Y EL ADULTO MAYOR

- Los adultos mayores tienen mayor riesgo de toxicidad por quimioterapia
  - Hasta 50% en ensayos clínicos aleatorizados
- Las consecuencias de la toxicidad son diferentes
  - Incluso la toxicidad leve puede deteriorar la funcionalidad
- Difícil de predecir
- Dificultades para reportar toxicidad de forma oportuna



# EL EJEMPLO DE LOS DESENLACES AUTOREPORTADOS

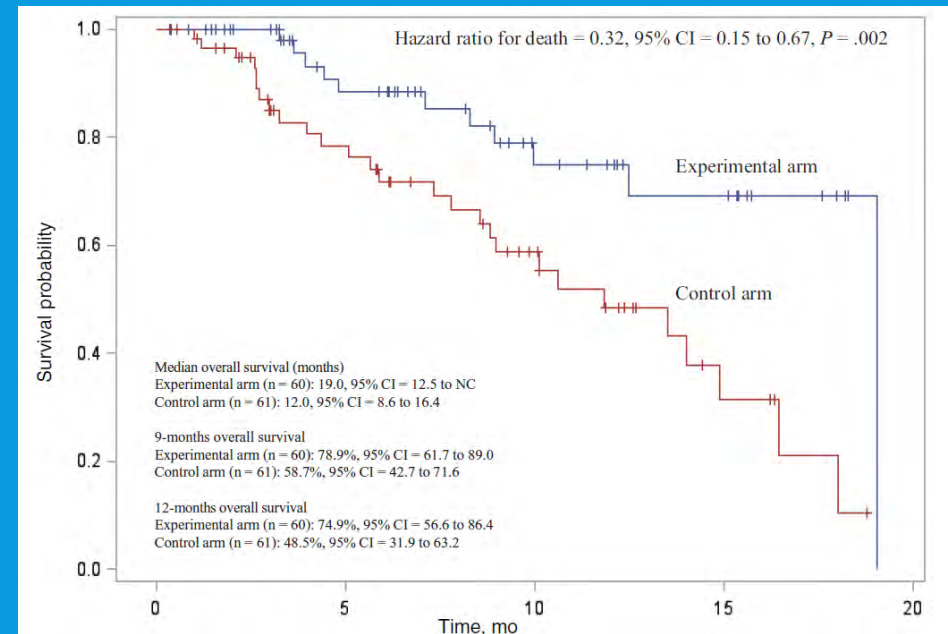
- Interfaz para el auto-reporte de síntomas
  - En línea
  - Sistema telefónico
- Mejora la calidad de vida
- Reduce las hospitalizaciones
- Mejora la supervivencia global



**Edad promedio 61 años**  
**MSKCC**

# EL EJEMPLO DE LOS DESENLACES AUTOREPORTADOS

- Interfaz para el auto-reporte de síntomas
  - En línea
  - Sistema telefónico
- Mejora la calidad de vida
- Reduce las hospitalizaciones
- Mejora la supervivencia global



**Edad promedio 64.5 años**  
**5 hospitales franceses**

# ¿PUEDE APLICARSE A LOS PAÍSES EN DESARROLLO?

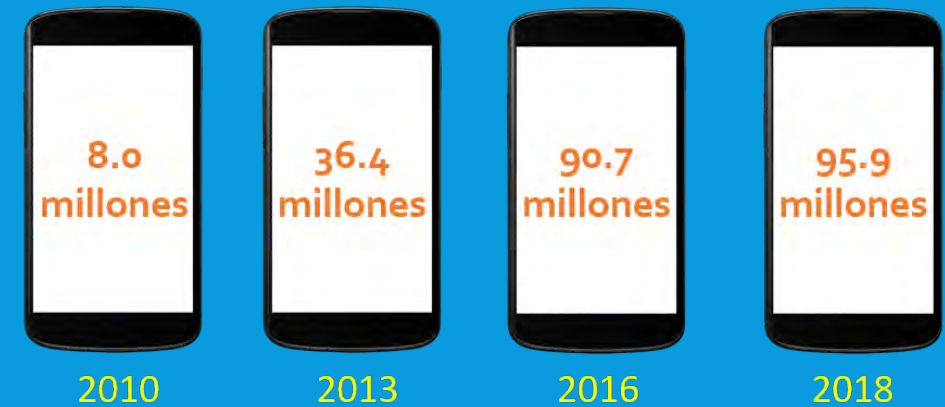
- Barreras geográficas
  - 30% de la población vive en zonas rurales remotas
- Falta de personal
  - 1.07 oncólogos por cada 100,000 habitantes
- Falta de sistemas de valoración telefónica
- Las toxicidades no se detectan de forma oportuna
  - **Extremadamente relevante para los adultos mayores**

**¿Cómo podemos detectar y mitigar la toxicidad a distancia de una forma efectiva?**



# LA TECNOLOGÍA MÓVIL COMO POTENCIAL SOLUCIÓN

- Los mexicanos tienen más de 90 millones de smartphones
- Estrategia de comunicación óptima
- Valoración remota de toxicidad
- Datos emergentes de países desarrollados
  - Difícil de extrapolar al mundo en desarrollo
- No hay intervenciones específicas para adultos mayores
  - Preocupaciones sobre habilidad técnica



# LA TECNOLOGÍA MÓVIL COMO POTENCIAL SOLUCIÓN

- El deterioro funcional es un marcador de toxicidad en adultos mayores con cáncer
- La movilidad puede medirse utilizando el acelerómetro del *smartphone*

**Hipótesis: El deterioro funcional (disminución en el número de pasos) podría ser un método novedoso para la detección de toxicidad en adultos mayores recibiendo quimioterapia en México.**

## Monitorización diaria

- Se realizaron llamadas al encontrarse una **disminución  $\geq 15\%$**  en la media de pasos por día
- Valoración de toxicidad
- Implementación de intervenciones

Psicológico	MHI-17
Cognición	BOMC

≥ Una semana antes de iniciar quimioterapia

- Datos sociodemográficos
- Características clínicas
- Valoración Geriátrica\*

# Media de pasos por día obtenida

↓

Uso del teléfono por una semana

- Mediciones basales
- Número de pasos por día

Inicio de la Quimioterapia

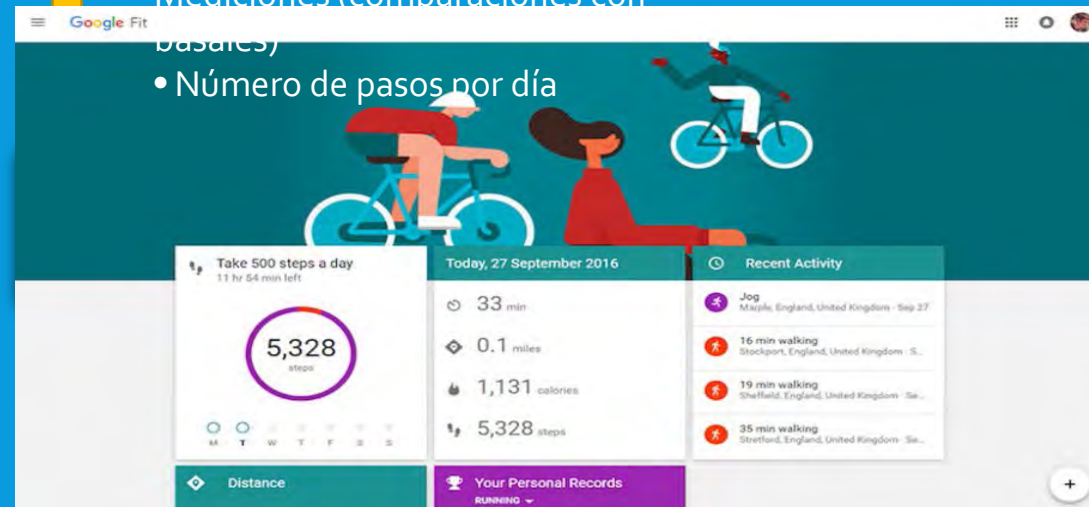
- Educación sobre efectos adversos de forma usual

↓

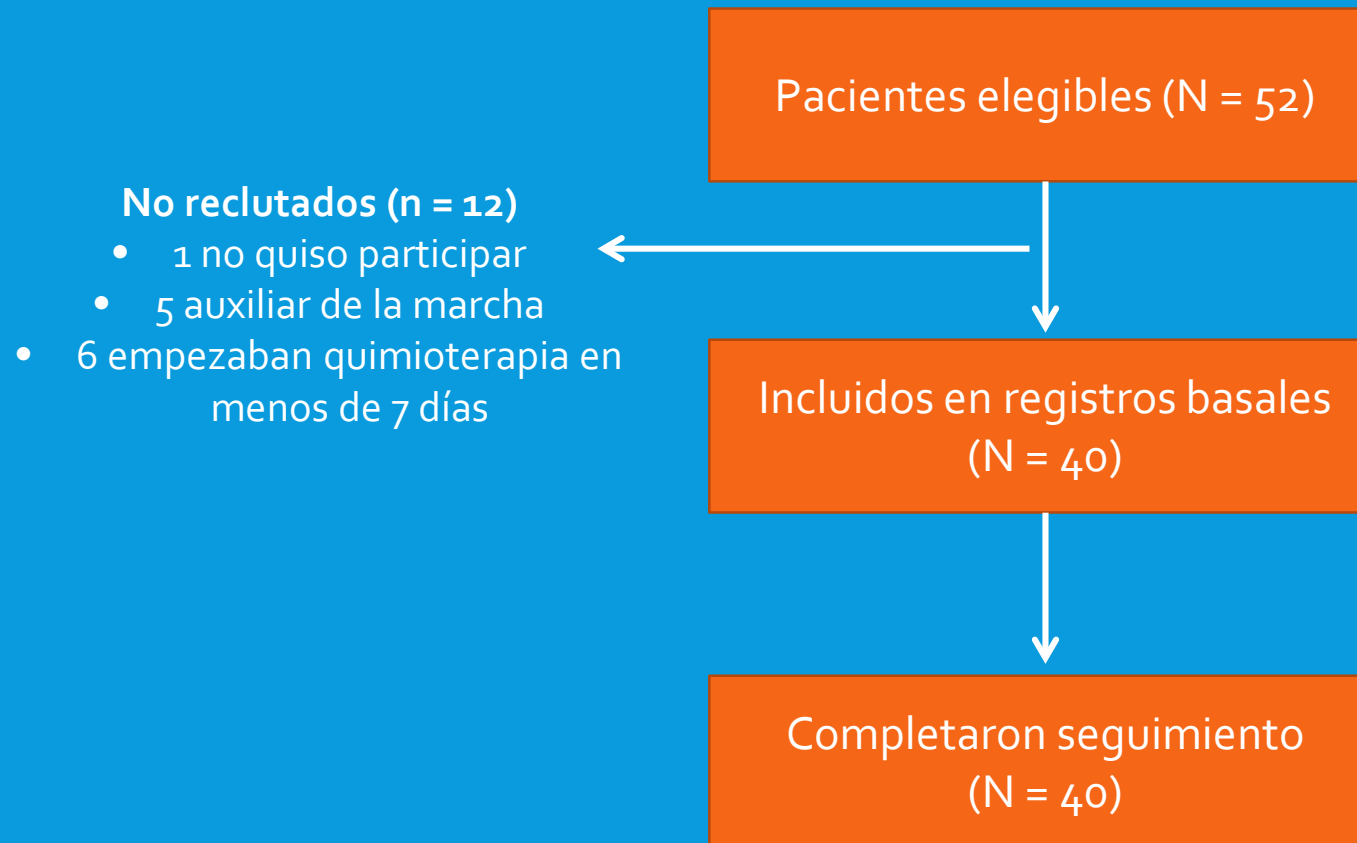
Uso del teléfono por un ciclo

Mediciones (comparaciones con basales)

- Número de pasos por día



# DIAGRAMA DE FLUJO



# CARACTERÍSTICAS DEMOGRÁFICAS

Característica	N = 40
<b>Género</b>	
Hombre	17 (43%)
Mujer	23 (57%)
<b>Mediana de edad, años</b>	<b>72.5</b>
<b>Rango</b>	<b>65-89</b>
<b>Tipo de tumor</b>	
Gastrointestinal	18 (45%)
Mama	9 (23%)
Genitourinario	4 (10%)
Ginecológico	4 (10%)
Sarcoma	4 (10%)
Pulmón	1 (2.5%)
<b>Etapa</b>	
I-II	12 (30%)
<b>III-IV</b>	<b>28(70%)</b>

Característica	N = 40
<b>Tipo de quimioterapia</b>	
Monoterapia	18 (45%)
Poliquimioterapia	22 (55%)
<b>Reducción de dosis</b>	
No	25 (62.5%)
Sí	15 (37.5%)
<b>Nivel educativo</b>	
<b>Menos de preparatoria</b>	<b>24 (60%)</b>
Preparatoria o más	16 (40%)
<b>Uso previo de teléfono móvil</b>	
Sí	25 (65%)
No	14 (35%)
<b>Uso previo de smartphone</b>	<b>9 (22.5%)</b>
<b>Distancia mediana al hospital (km)</b>	<b>23</b>
<b>Rango</b>	<b>1.9-1232</b>



# VALORACIÓN GERIÁTRICA

Dominio	N = 40
<b>Funcionalidad</b>	
Independiente en AIVD	17 (43%)
<b>Dependiente en AIVD</b>	<b>23 (57%)</b>
≥ 1 caída en los últimos 6 meses	14 (35%)
<b>Desempeño físico</b>	
Mediana Timed Up and Go, seg	11
Rango	5.8-17.5
<b>TUG ≥ 13 segundos</b>	<b>10 (25%)</b>
<b>Comorbilidades</b>	
Mediana de comorbilidades	2
Rango	0-7
Pacientes sin comorbilidades	4 (10%)
<b>Nutrición</b>	
Mediana IMC	26.3
<b>Pérdida de peso &gt; 5%</b>	<b>22 (55%)</b>

Dominio	N = 40
<b>Viviendo solos o con otro adulto mayor</b>	<b>25 (63%)</b>
<b>Polifarmacia</b>	
Mediana de medicamentos	3
Rango	0-10
<b>Psicológico</b>	
MHI-17 (DE)	72.3 (18.43)
<b>Cognición</b>	
BOMC ≥ 11	3 (7.5%)
<b>Déficit auditivo</b>	<b>15 (37.5%)</b>
<b>Déficit visual</b>	<b>13 (32.5%)</b>

# MEDICIÓN BASAL DE ACTIVIDAD FÍSICA

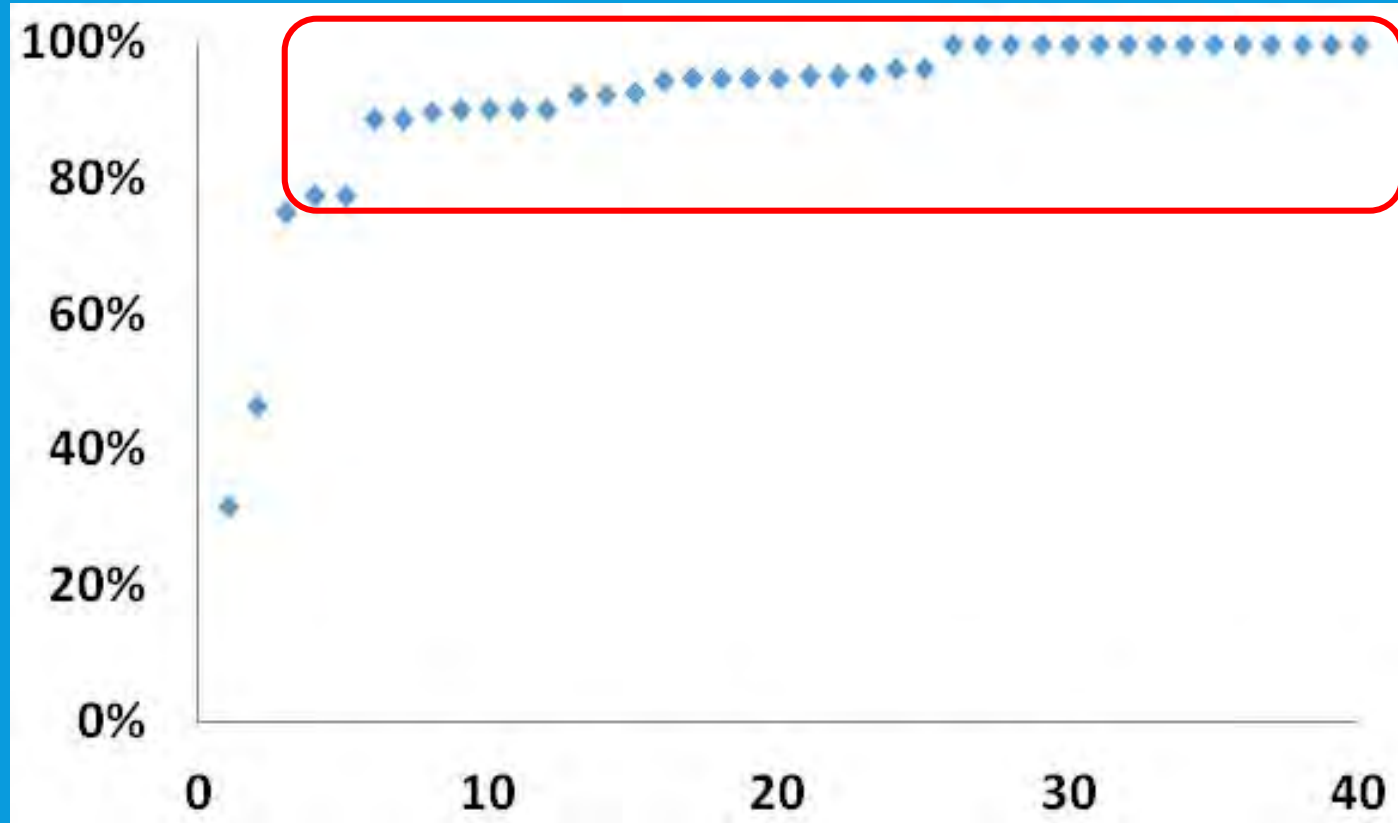
	N = 40
Número de días con pasos registrados (mediana)	11
Rango	7-38
Promedio de pasos por día (DE)	3110 (1731.8)

# FACTIBILIDAD

	N = 40
Número de días de seguimiento	21
Rango	2-28
Proporción del ciclo con pasos registrados (SD)	90% (0.14)
Pacientes con pasos registrados en >75% del ciclo	93%

# FACTIBILIDAD

Días del ciclo de quimioterapia (%)



Pacientes

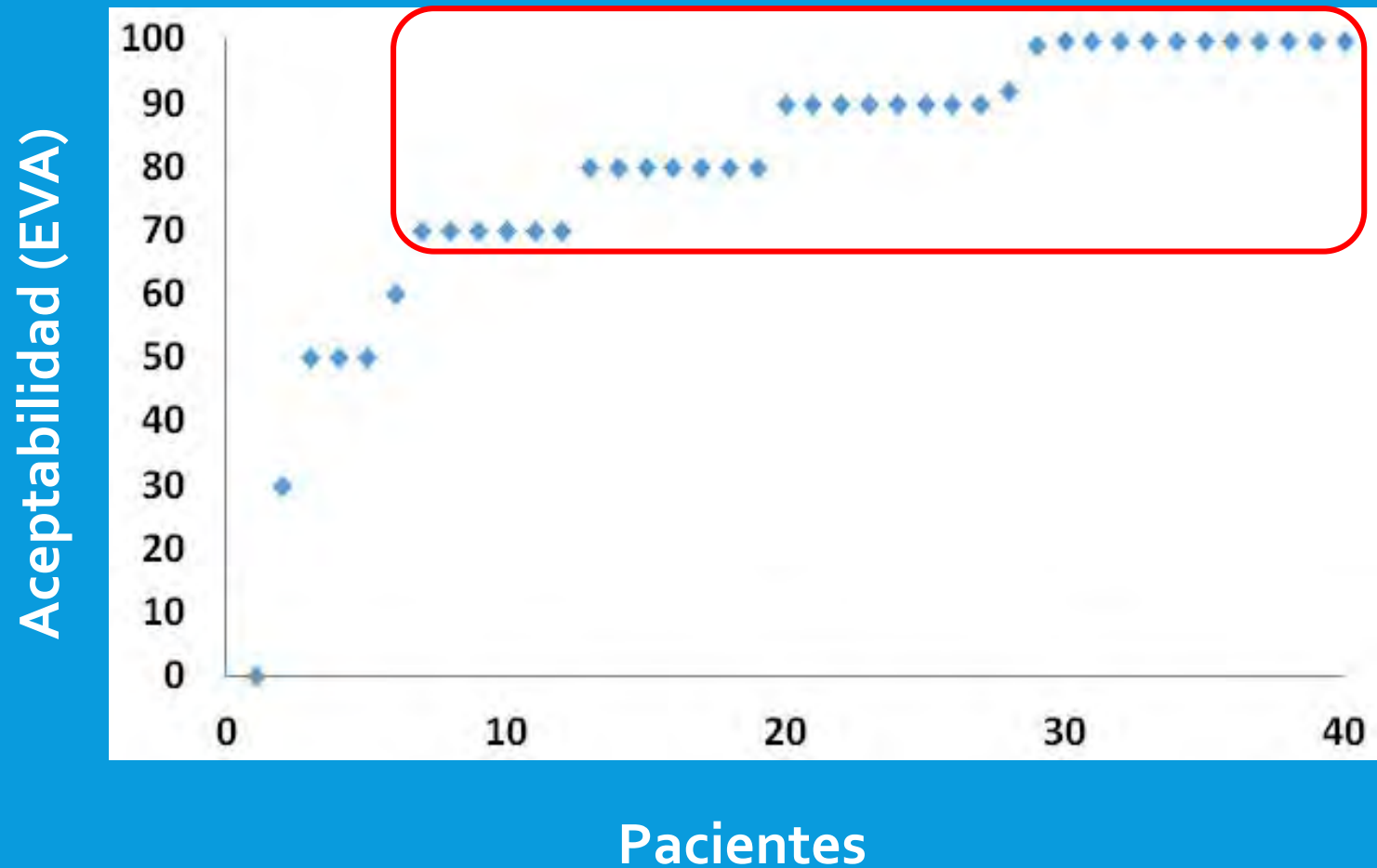
**El 93% lo utilizó correctamente**

# ACEPTABILIDAD

	N = 40
Mediana de aceptabilidad en la EVA	90
Rango	0-100
Proporción de pacientes que lo consideraron fácil de usar	85%



# ACEPTABILIDAD



**El 85% lo consideró  
aceptable y fácil de  
usar**

# RESULTADOS

- Hubo una disminución en el número de pasos en el **50% de los días**
- 31 pacientes (77.5%) tuvieron toxicidades clínicamente significativas que fueron detectadas usando el *smartphone*

La toxicidad se manejó por teléfono en 60% (n=24) de los pacientes

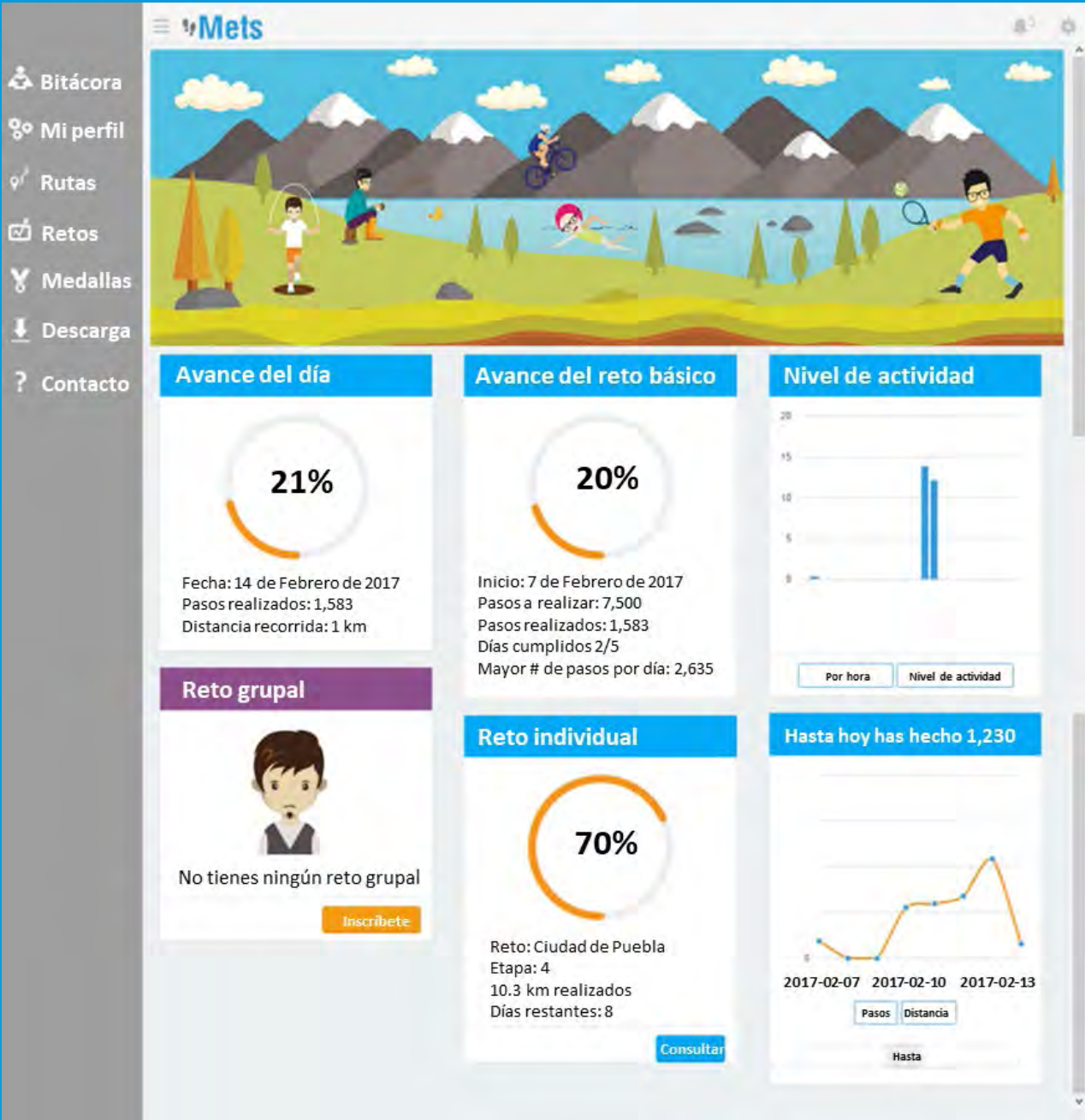
25% de los pacientes (n = 10) fueron enviados a urgencias

12.5% de los pacientes (n = 5) fueron hospitalizados

# CONCLUSIONES

- Usar smartphones para valorar la movilidad de los adultos mayores recibiendo quimioterapia en México es **factible**.
- A pesar de tener poca exposición previa a la tecnología móvil, los participantes consideraron que la intervención fue **sencilla y aceptable**.
- Las disminuciones en el número de pasos fueron comunes y se asociaron a toxicidad de la quimioterapia

# Desarrollo de una interfaz de visualización simultanea



# SIGUIENTES PASOS

- **Precisión** del sistema
  - Establecer el punto de corte preciso en la disminución en el número de pasos que predice toxicidad
- **Adherencia** a largo plazo
- Obtener patrones de actividad más complejos que puedan ser indicadores de toxicidad a través de *machine learning*

Estudio prospectivo con  
**120 adultos mayores con  
cáncer** recibiendo  
quimioterapia con un  
seguimiento de 3 meses



**Impacto clínico  
directo**

# POSIBILIDADES DE COOPERACIÓN



- Conexión con expertos en diseño de software y tecnología
- *Big data y machine learning*
- Wearables
- “Casas inteligentes”
- Telemedicina

**Desarrollar métodos  
novedosos de seguimiento a  
distancia para pacientes  
vulnerables utilizando  
tecnología accesible y barata**








**Introducing:**

Carmen García-Peña  
Luis Miguel Gutiérrez-Robledo  
Mario Ulises Pérez-Zepeda *Editors*

# Aging Research - Methodological Issues

*Second Edition*

 Springer

Carmen García-Peña · Luis Miguel Gutiérrez-Robledo · Mario Ulises Pérez-Zepeda *Editors*  
**Aging Research - Methodological Issues**

This book reviews classical epidemiological and clinical research studies, with a focus on aging. Chapters cover methodological topics like the scientific method, ethics, and the consequences of certain inclusion criteria, and the work includes a look at clinical concepts like multimorbidity, frailty and functionality. The authors reveal the issues and challenges for researchers of age and aging, and also consider the translation of scientific knowledge, from basic to clinical, and from clinical to public policies of social and health care.

The focus on aging is what gives this book its valuable perspective on research methodology. All authors have considerable experience in aging, geriatrics or gerontology, and each chapter includes both a theoretical framework and practical examples of studies in aging. Readers will discover study designs that are reviewed for basic structure, main flaws and advantages, and are analyzed for specific conditions and variables regarding aging.

This text is suited to both health care professionals caring for older adults, and researchers who are new to research in aging. It is relevant across the disciplines, including medicine, psychology, social sciences and dentistry, and it supports learning with graphs and figures.

BioMedicine



• [springer.com](http://springer.com)

García-Peña · Gutiérrez-Robledo ·  
Pérez-Zepeda *Eds.*



Aging Research - Methodological  
Issues

Carmen García-Peña ·  
Luis Miguel Gutiérrez-Robledo  
Mario Ulises Pérez-Zepeda *Editors*

# Aging Research - Methodological Issues

Springer

INSTITUTO  
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  - 6 countries
  - 20 institutions



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# Temática

- 1 The Need for Differentiated Research Methodology in Aging** Mario Ulises Pérez-Zepeda, Carmen García-Peña, and Luis Miguel Gutiérrez-Robledo
- 2 The Scientific Method as a Point of Departure in Aging Research** Ruben Fossion and Leonardo Zapata-Fonseca
- 3 Biomedical Research in Aging** José Mario González-Meljem, Scott Haston, Suchira Gallage, and Andrew J. Innes
- 4 Geroscience** Isabel Arrieta-Cruz and Armando Luna-López
- 5 Descriptive Studies in Clinical Gerontology and Geriatrics** Mario Ulises Pérez-Zepeda, Lorena Jocabed Rocha Balcázar, and Miguel Germán Borda
- 6 Qualitative Research in Gerontology and Geriatrics** Fernando A. Wagner, Laurens G. Van Sluytman, Halaevalu F. Ofahengaue Vakalahi, and Chioma Nwakanma Wosu
- 7 Case-Control Studies in Aging Research** Sergio Sánchez-García, Erika Heredia-Ponce, Luis Pablo Cruz-Hervert, Ángel Cárdenas-Bahena, Laura Bárbara Velázquez-Olmedo, and Carmen García-Peña
- 8 Longitudinal Studies and Older Adults Cohorts** Carmen García-Peña, Claudia Espinel-Bermúdez, Pamela Tella-Vega, Mario Ulises Pérez-Zepeda, and Luis Miguel Gutiérrez-Robledo
- 9 Clinical Trials on Aging Research** Mario Ulises Pérez-Zepeda, Antonio Cherubini, Carmen García-Peña, Elisa Zengarini, and Luis Miguel Gutiérrez-Robledo



# Temática

**10 Mixed Methods in Geriatrics and Gerontology Research** Joseph J. Gallo and Jin Hui Joo

**11 Systematic Reviews and Meta-Analysis in Aging Research** Miguel Ángel Villasís-Keever, Mario Enrique Rendón-Macías, and Raúl Hernán Medina-Campos

**12 Health Systems Research in Aging** Hortensia Reyes-Morales, Svetlana V. Doubova, and Ricardo Pérez-Cuevas

**13 Technology and Aging: Ubiquitous Sensing Technology for Aging Research** Jesús Favela and Luis A. Castro

**14 The Challenge of Big Data and Data Mining in Aging Research** Juan Carlos Gómez-Verján and Luis Miguel Gutiérrez-Robledo

**15 Research in Public Policies for Aging** Elizabeth Caro-López and Ernesto Velasco-Sánchez

**16 Ethical Issues in Research in Aging** Tirso Zúñiga-Santamaría and Carmen Jimena Vázquez-García

**17 Integration of Consortiums and Search for International Funding** David X. Marquez, Iraida V. Carrion, Susan Aguiñaga, and Melissa Lamar

**18 Future of Aging Research** Matteo Cesari, Marco Canevelli, and Mario Ulises Pérez-Zepeda

# INNOVATIONS

- Drivers of the first edition are the same for this second: Aging population process represents the most important demographic issue in the world and particularly in low and middle economies that are currently facing several challenges in the social, economic, welfare, and health services dimensions among others.
- The second edition maintains the aim of integrating crucial features in aging research, such as multimorbidity, frailty, function, cognition, healthy aging with the principles of research methodology.
- Twelve previous chapters were reviewed and updated.
- Chapter 15 is a discussion about the transference of health research results into aging policy; focusing in the urgent need of evidence in all the health systems to make better decisions in the aging field, taking advantage of what research provides to stakeholders.
- The discussion about the relationship between technology and aging was also included, with special emphasis on ubiquitous sensing, a continuously growing field both in engineering and aging.



# Six new chapters were included:

- Chapter 4 dedicated to **Geroscience** which is a modern and emerging discipline based on finding connections between the “hallmarks of aging.”
- Chapter 12 is focused on **health systems research** in aging. Health services have been particularly challenged due to an increase of health demands but also of a lack of scientific evidence.
- **Big data** and data mining are discussed in Chap. 14. Both are powerful tools to obtain information that could be used to improve the health status of older people.
- **Ethical considerations** in aging research are presented in Chap. 16. This chapter argues that such exceeding medical research should always be accompanied by an ethical stance, specifically focusing on aging population. The ethical stance in research serves to, first and foremost, look to safeguard the dignity of those it researches.
- Chapter 17 presents a crucial topic, the process involved with searching for **aging research funding**. Very specific key points are presented in order to write and present a successful grant proposal when focusing on the aging field.
- Finally, Chap. 18 is focused on discussion of the **future of aging research**, and how we need to move from disease paradigms to understand the person with a holistic perspective.



- We hope that under- and post-graduate students who are interested in aging research for the first time find this book challenging and useful.
- Senior researchers that have not done research in the area also can find a different perspective, and refreshing concepts may be found all over the diverse chapters.
- Aging research must be as a top priority of any national research agenda. As in other medical branches, researchers need to be well trained and prepared; enough funds and institutional supports are needed to obtain sounding data that has the potential to impact how older adults are taken care of in all areas of the society.
- After all, obtaining results with a standardized methodology will lead in turn to the formulation of new questions that will continue enriching the ever-growing field of aging research. We hope that this book will aid in achieving these goals.

# download:

- <https://www.springer.com/us/book/9783319953861>

# BIRDS

Reconnaissance des situations à risques dans la vie  
quotidienne des personnes fragiles.

QUI  
SOMMES-  
NOUS ?



Une entreprise innovante spécialisée dans  
la conception d'applications mobiles  
professionnelles avec objets connectés.





AUDIT & CONSEIL

AUTHENTIFICATION ET SÉCURITÉ

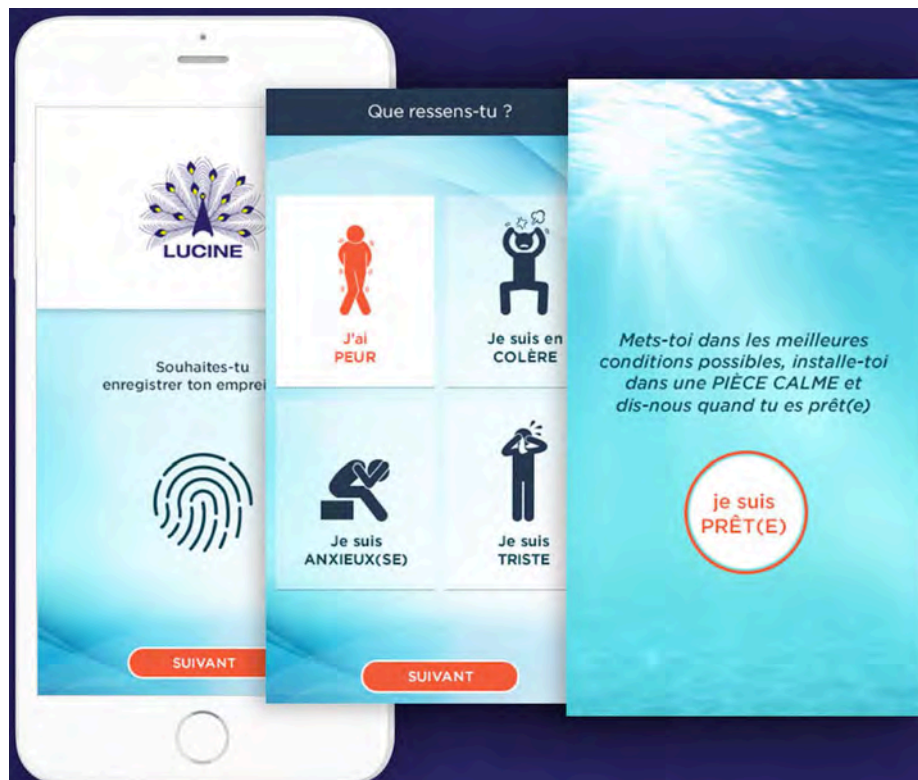
PROJET

FORMATION ET ACCOMPAGNEMENT

UN LABORATOIRE RECHERCHE ET  
DEVELOPPEMENT  
« ORIENTE SUR LE MARCHÉ »

**NOTRE EXPERTISE DIGITALE**

## Application mobile E-Health du projet Lucine



Montre connectée pour la téléassistance



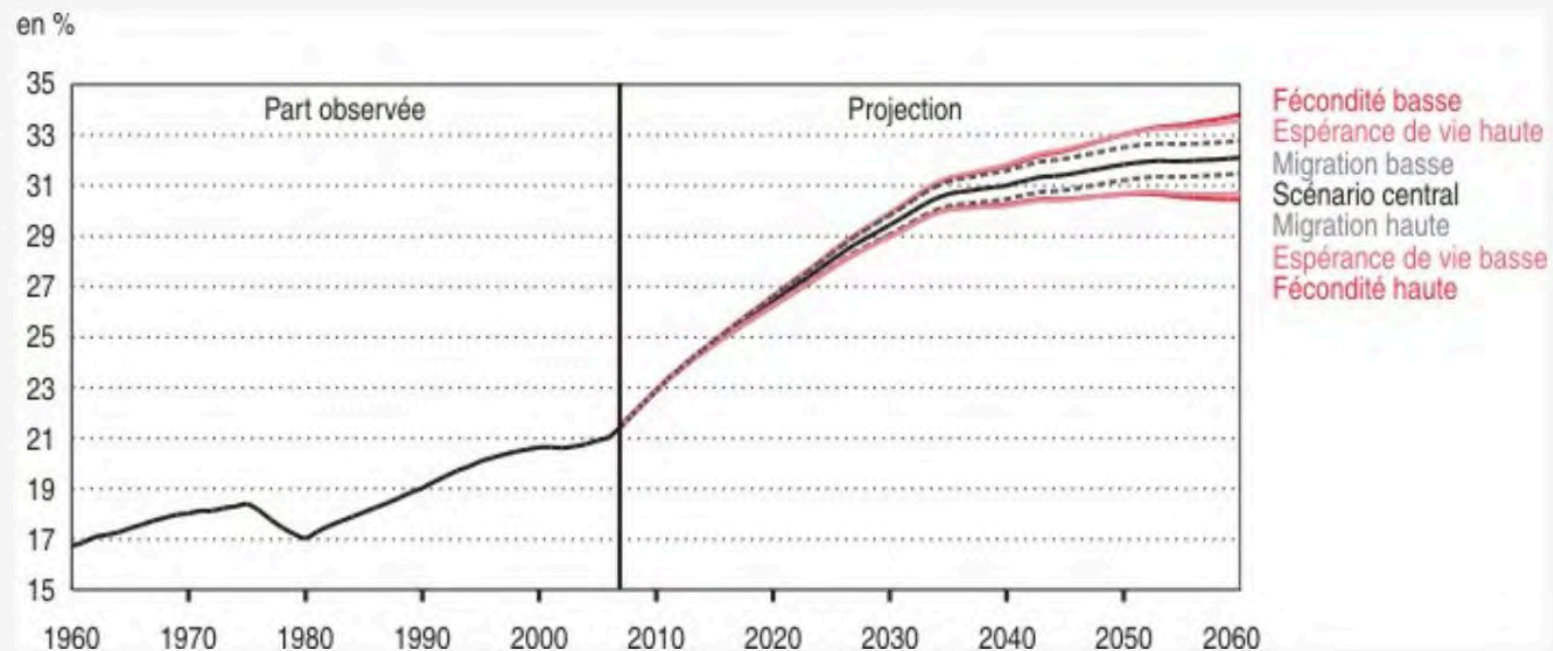
# TELECARE / E-HEALTH



PROJETS IOT ET  
E-HEALTH

# LE PROJET BIRDS :





source: INSEE projections du nombre des personnes âgées pour 2060.

- 1/3 de la population française +60 ans d'ici 2050.
- Nécessité du maintien de l'autonomie des personnes âgées.

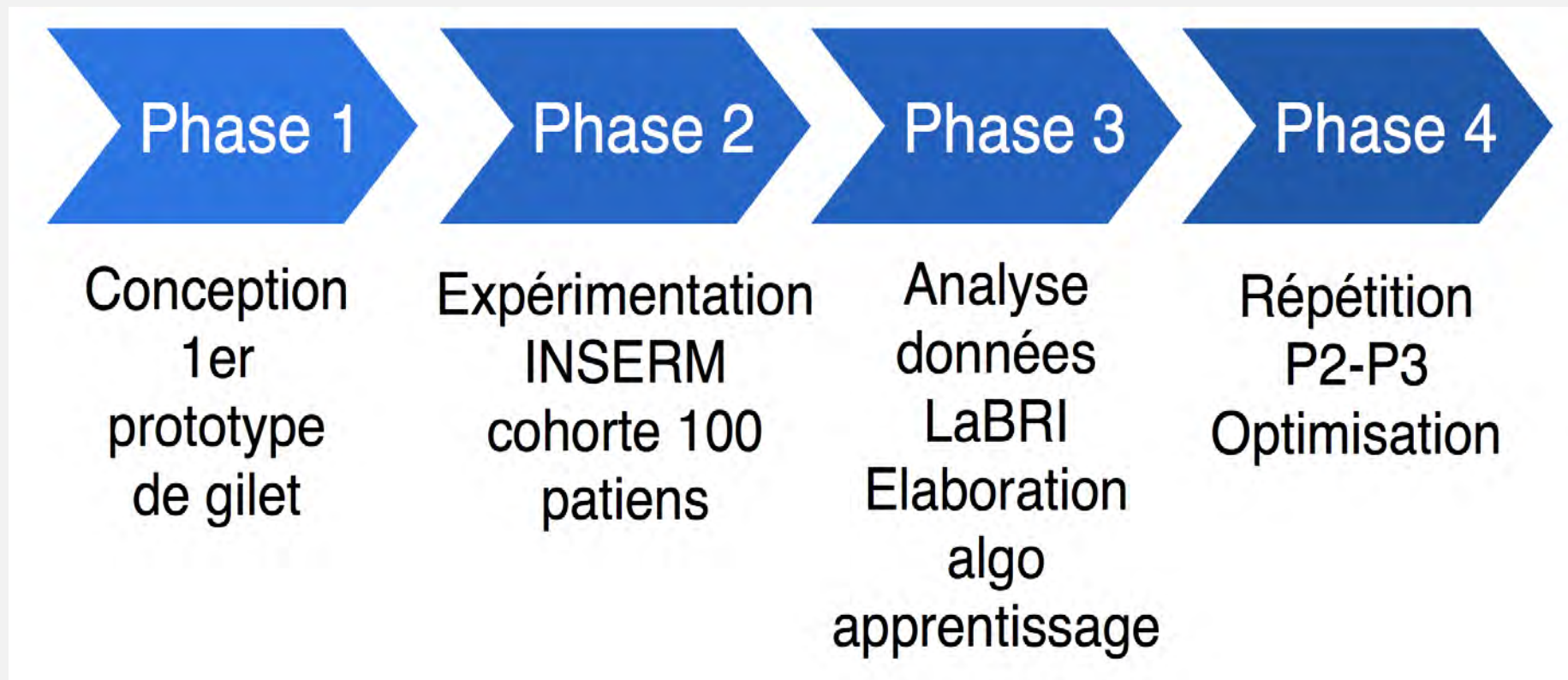
MOTIVATIONS  
DU PROJET  
BIRDS

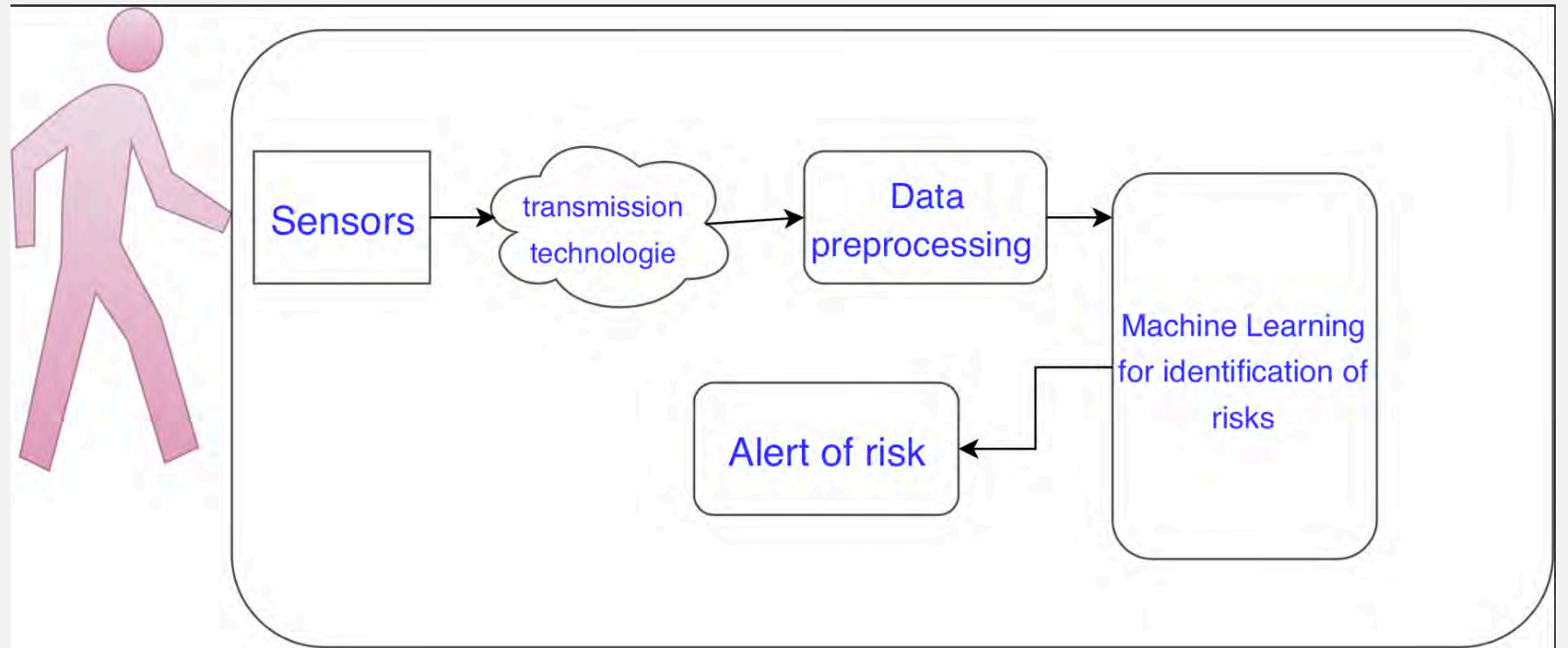
## Taxonomie des situations à risques

- Risque de chute
- Perte d'orientation
- Oublis majeurs dans les activités de vie courante
- Accidents domestiques
- Intrusion d'une tierce personne



# ETAPES D'EXÉCUTION DU PROJET

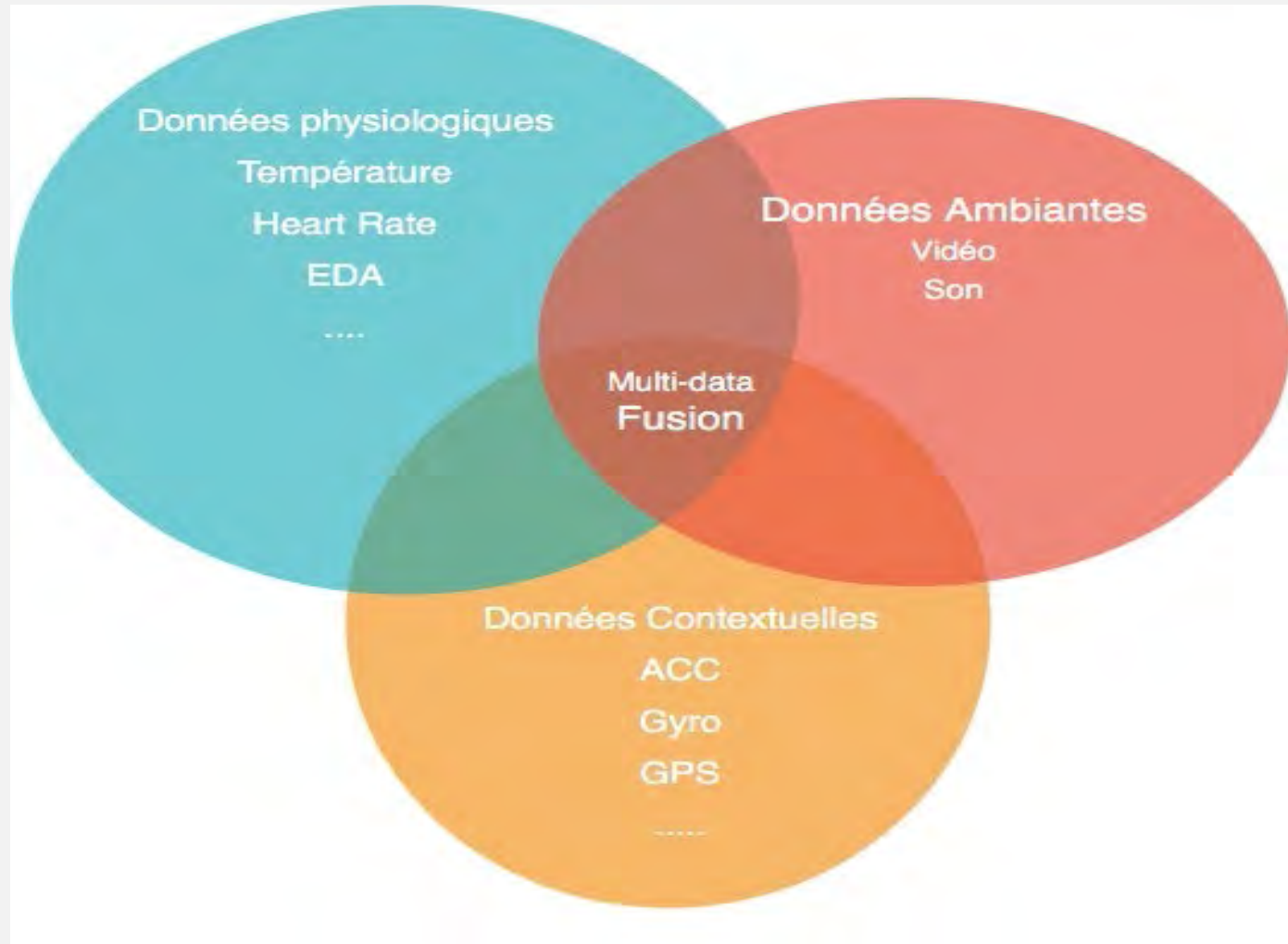




- Système de collecte de données
- Prétraitements des données
- Détection des situations à risques par intelligence artificielle

**SOLUTION  
PROPOSÉE**

# SOLUTION PROPOSÉE

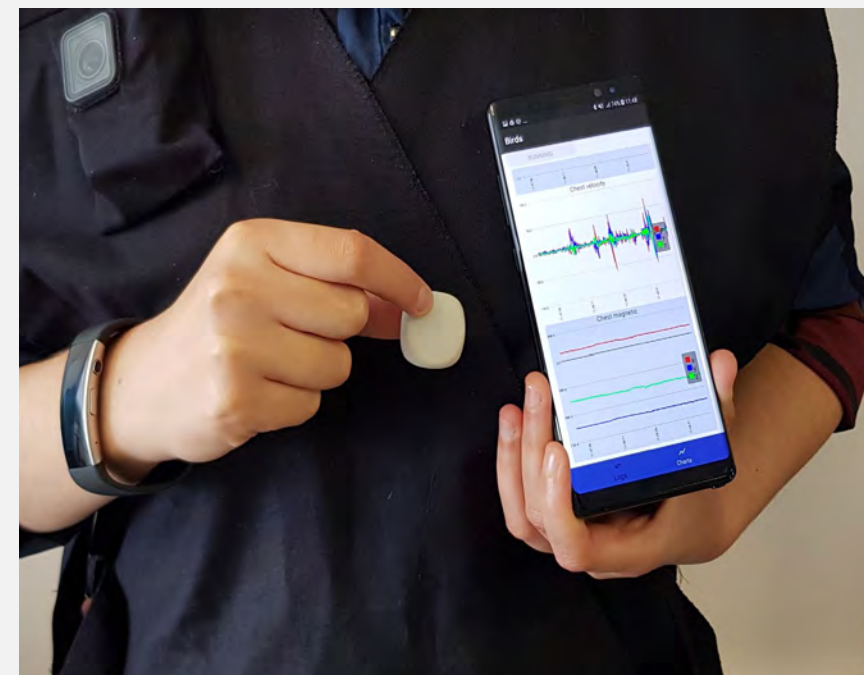
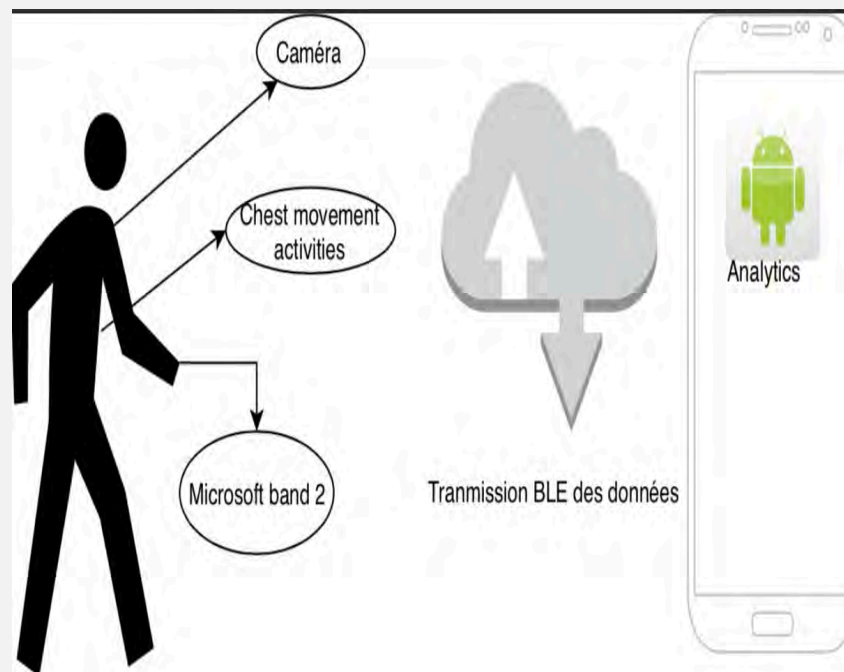


Utilisation des données multi-capteurs pour la détection des situations à risques par intelligence artificielle

## Les défis rencontrés sur le projet BIRDS

- Limitations matérielles
  - Capacité de stockage
  - Autonomie de la batterie
  - Défaillance des capteurs
- Synchronisation en temps réel des données multi-capteurs
- Intégration du dispositif dans la vie quotidienne du sujet

# Utilisation des données multi-capteurs pour la détection des situations à risques par intelligence artificielle



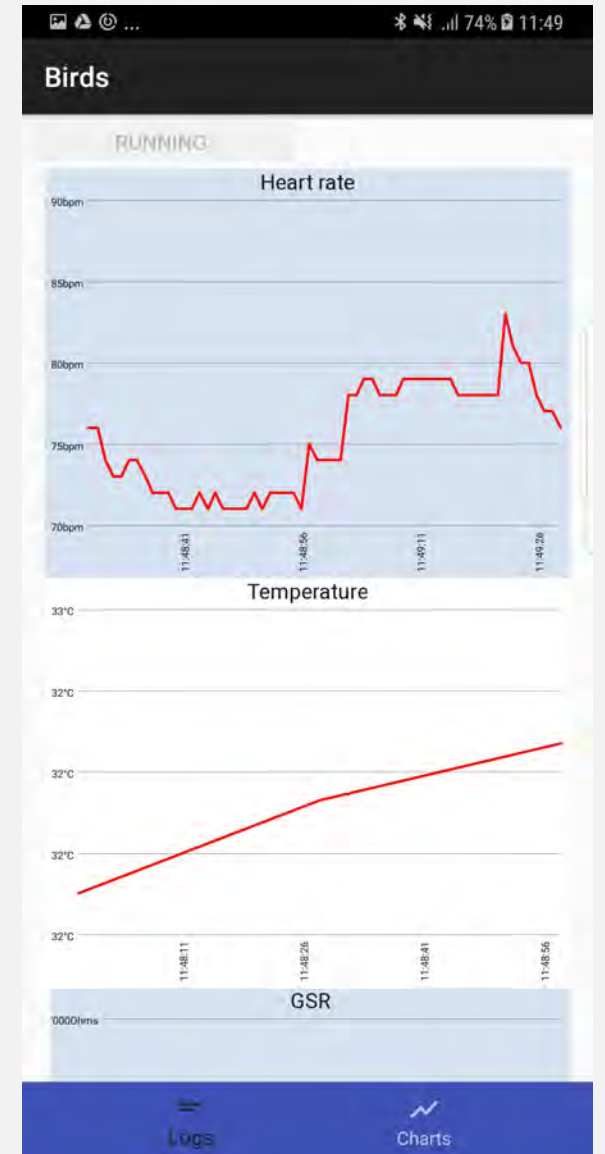
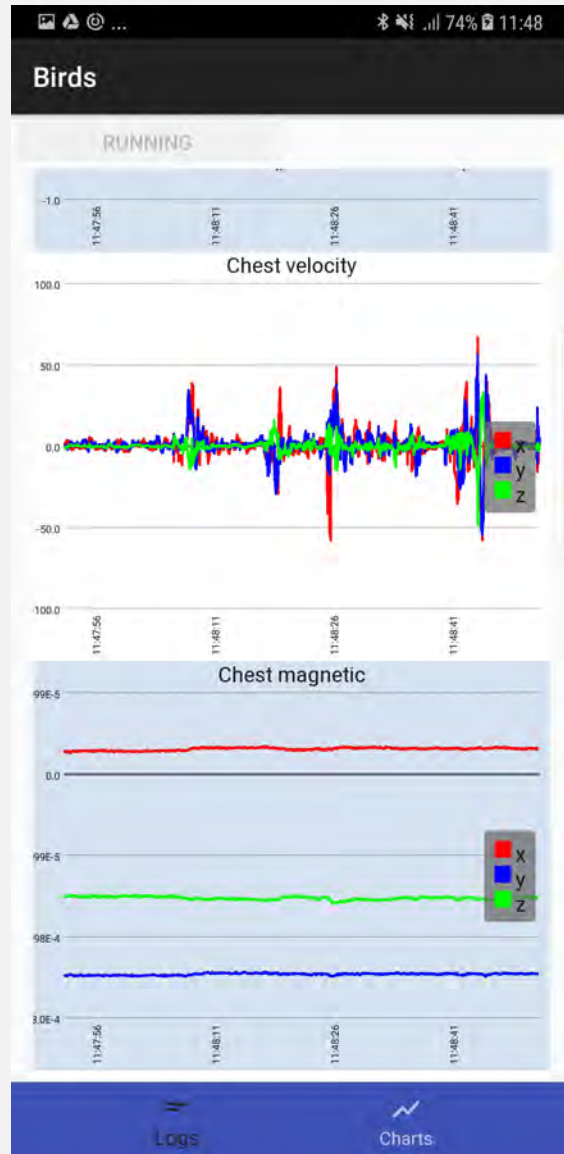
COLLECTE  
DE  
DONNÉES



# OBJECTIFS DU PROJET BIRDS

- Créer des outils e-sante IoT s'appuyant sur l'intelligence artificielle pour:
  - Monitoring
  - Téléassistance
- Permettre une analyse a posteriori de risques par le corps médical
  - Analyses statistiques des situations à risques
  - Permettre une exploitation sécurisée des données post projet Birds

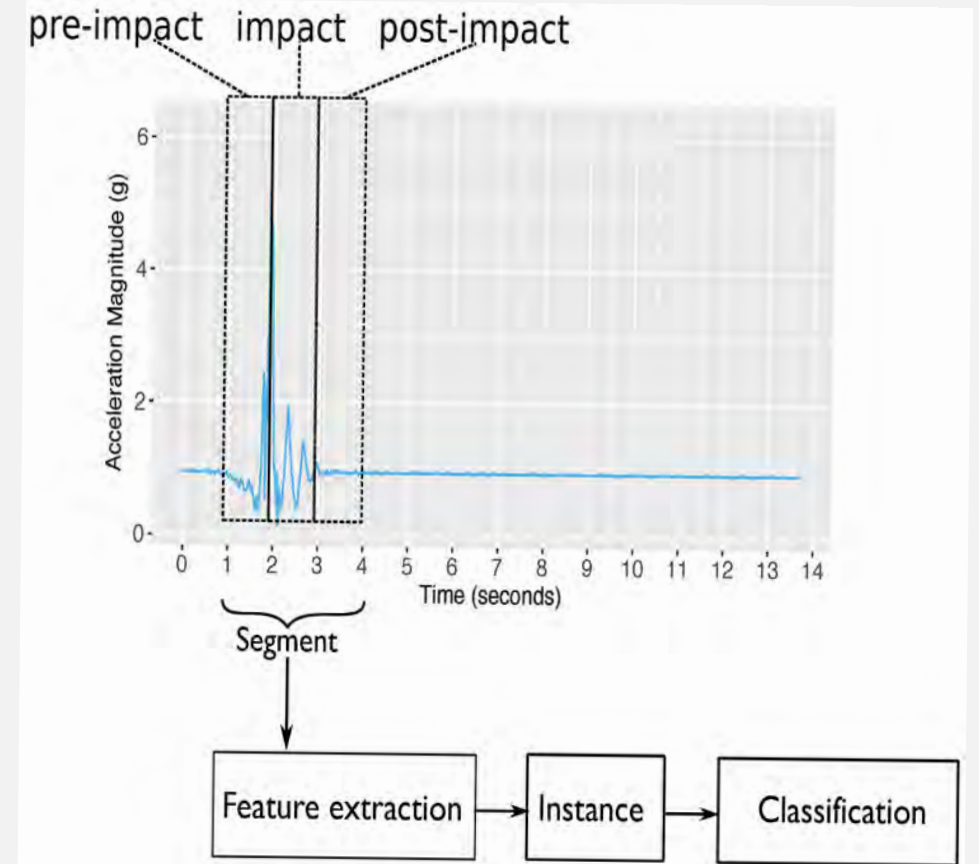
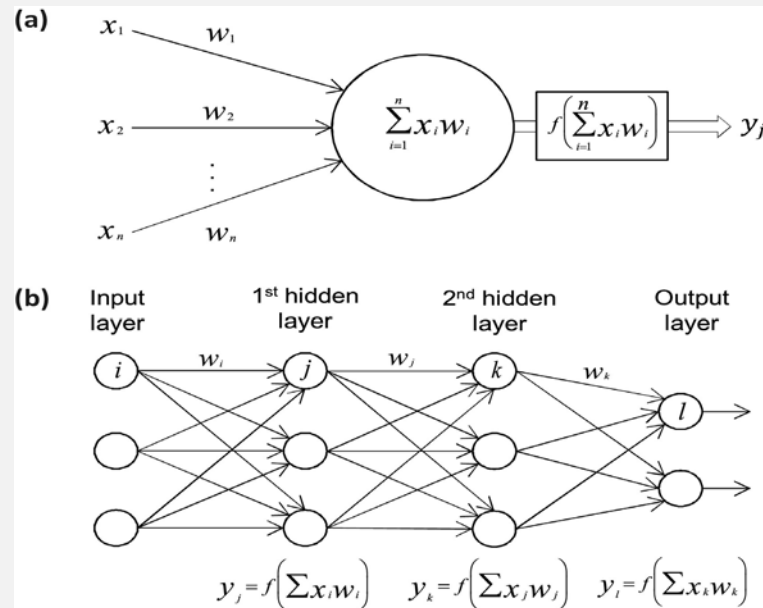
# DONNÉES RECUEILLIES SUR L'APPLICATION N BIRDS



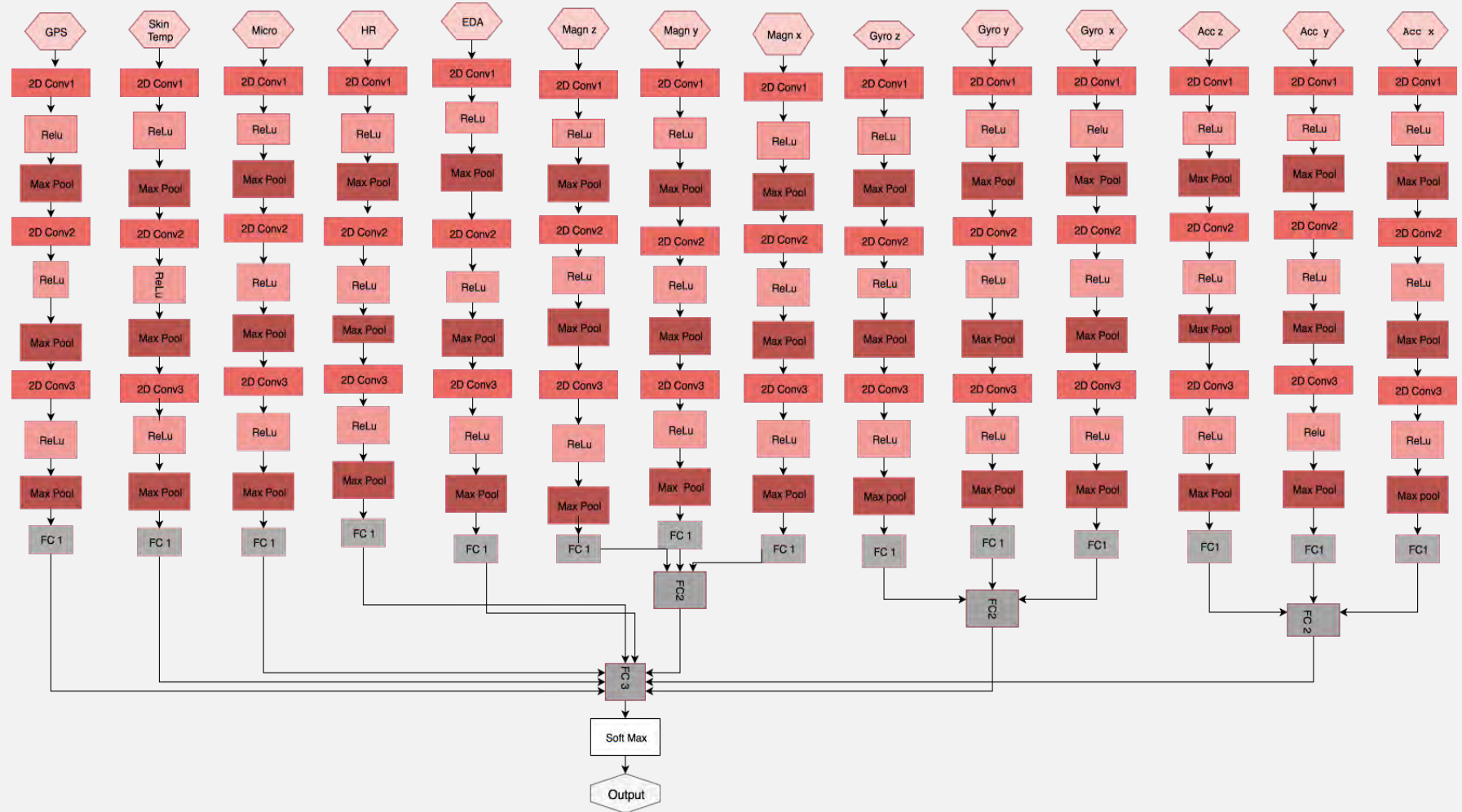
# ANALYSE DES DONNÉES COLLECTÉES

Classification des données en utilisant des modèles d'intelligence artificielle :

- Extraction des paramètres du signal.
- Apprentissage du modèle
- Prédiction de situation dangereuse.

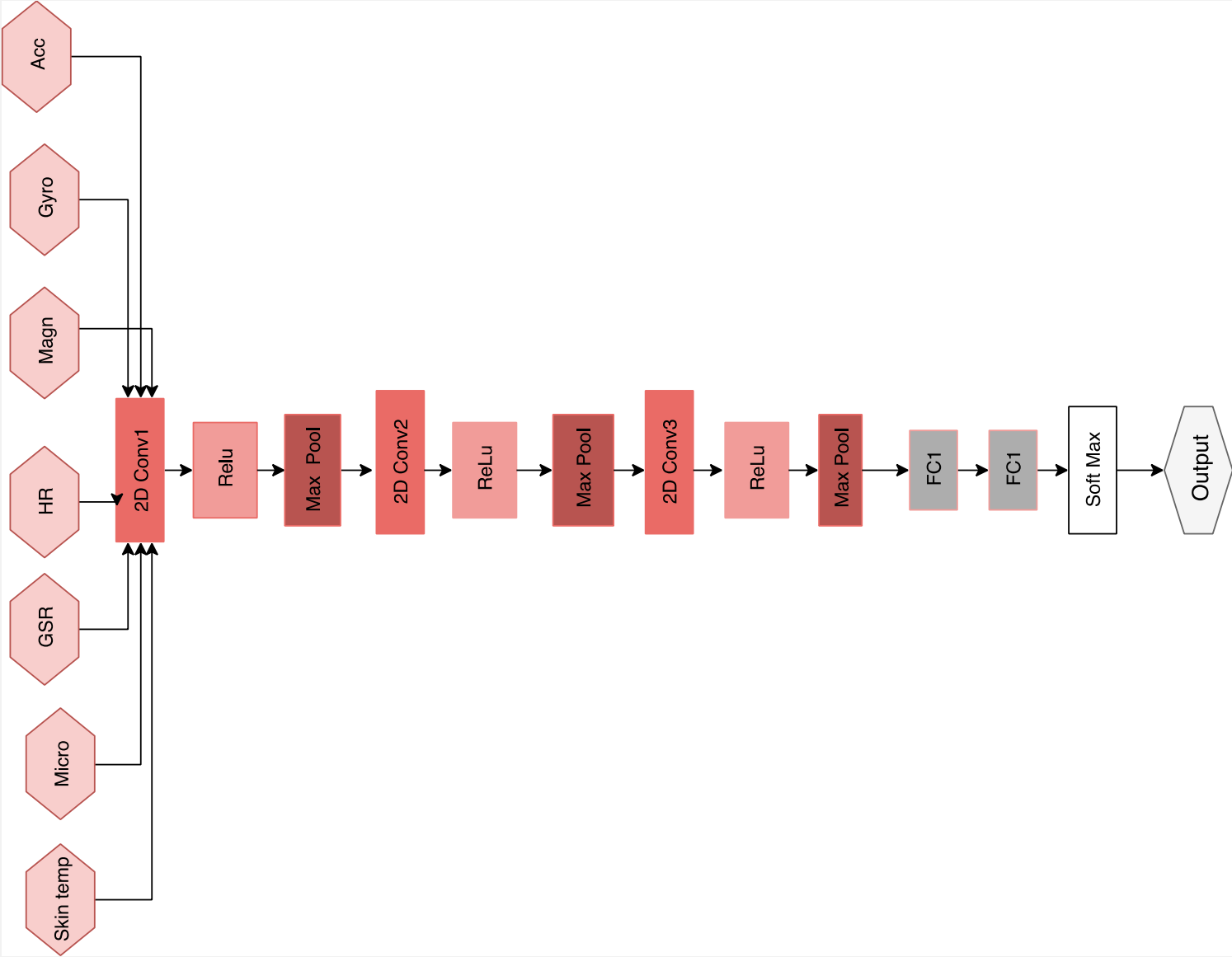


# ANALYSE DES SITUATIONS À RISQUES PAR UN RÉSEAU CNN SIAMOIS



ARCHITECTURE D'UN  
RÉSEAU  
D'APPRENTISSAGE  
PROFOND SIAMOIS

# ANALYSE DES SITUATIONS À RISQUES PAR UN RÉSEAU CNN EARLY FUSION



ARCHITECTURE D'UN  
RÉSEAU  
D'APPRENTISSAGE  
PROFOND EARLY  
FUSION



Merci pour votre attention

Gracias por su atención



# “Screen-based eye tracking to support Alzheimer’s disease diagnosis”

Dra. Jessica Beltrán Márquez

Dra. Mireya S. García-Vázquez

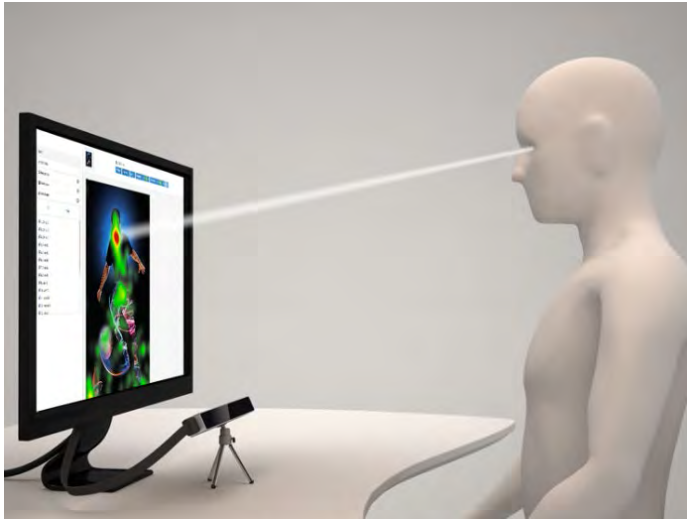


Taller Franco-Mexicano  
**Inteligencia Artificial: Aplicaciones e Investigación en  
Fragilidad y Demencias**  
22-23 de noviembre de 2018.

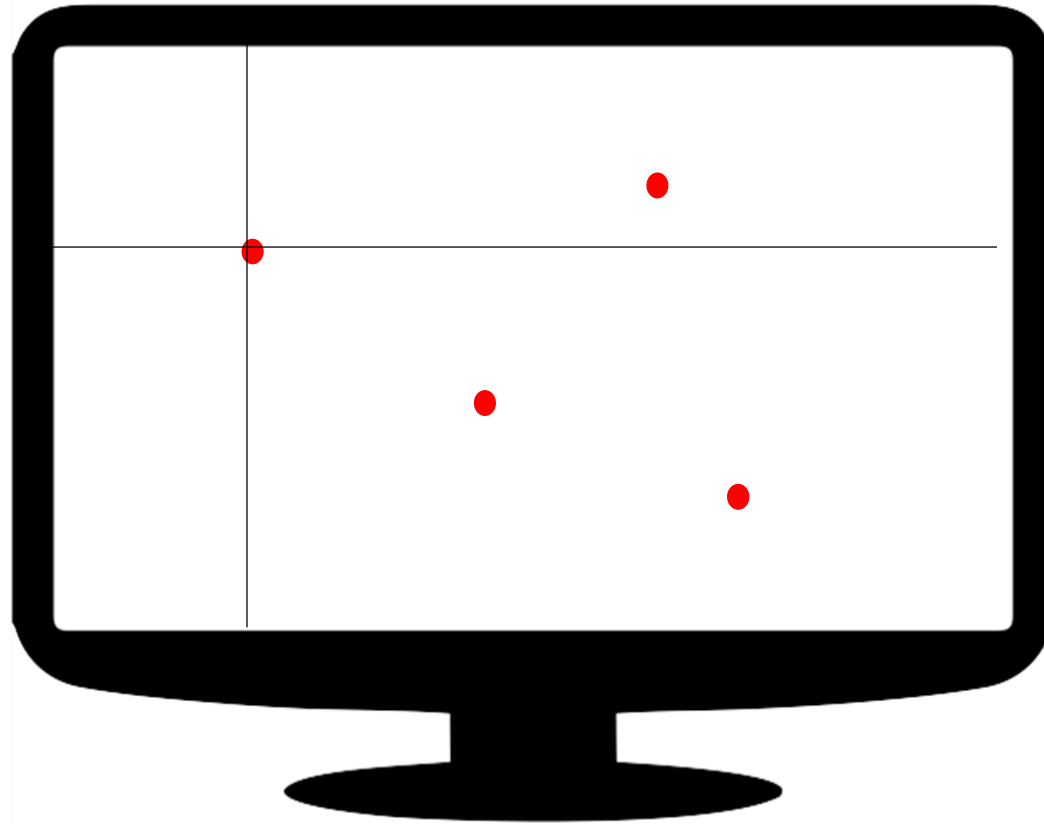


Red Temática  
Envejecimiento,  
Salud y Desarrollo Social

# Screen based eye tracking



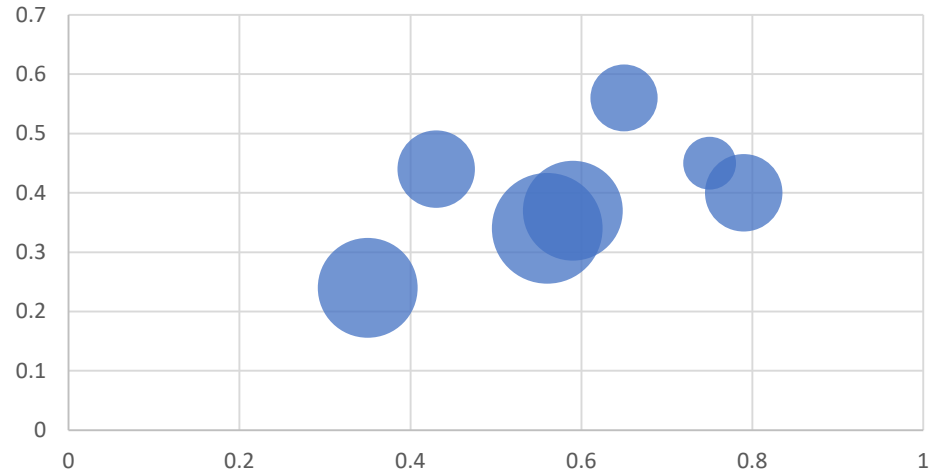
Screen based eye tracker



x	y	time
0.23	0.30	0.100
0.42	0.60	0.500
0.67	0.18	1.30
0.73	0.85	1.700

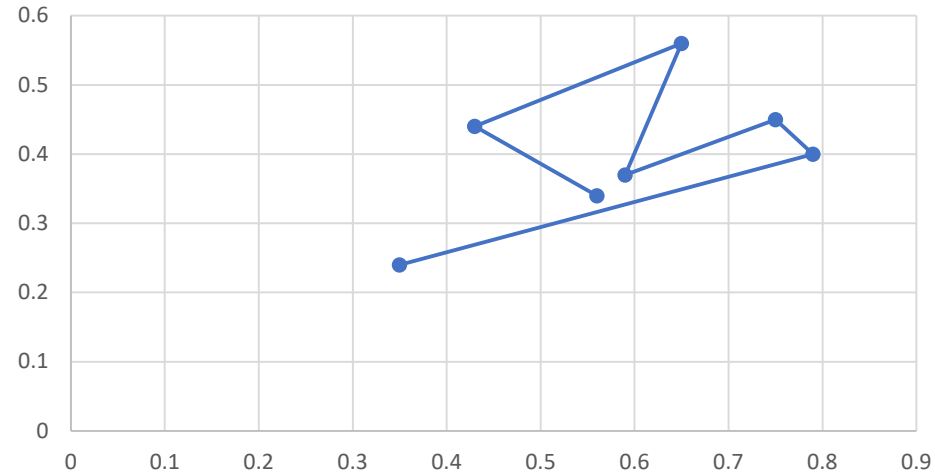
x	y	duration
0.56	0.34	2.453
0.43	0.44	1.2
0.65	0.56	0.9
0.59	0.37	1.987
0.75	0.45	0.56
0.79	0.4	1.2
0.35	0.24	2

Visualization of fixations

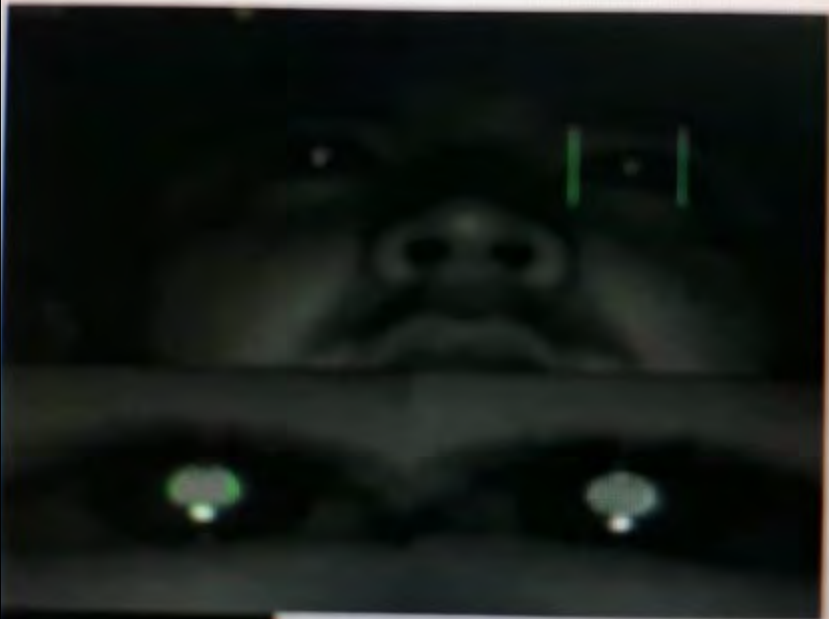


x	y
0.56	0.34
0.43	0.44
0.65	0.56
0.59	0.37
0.75	0.45
0.79	0.4
0.35	0.24

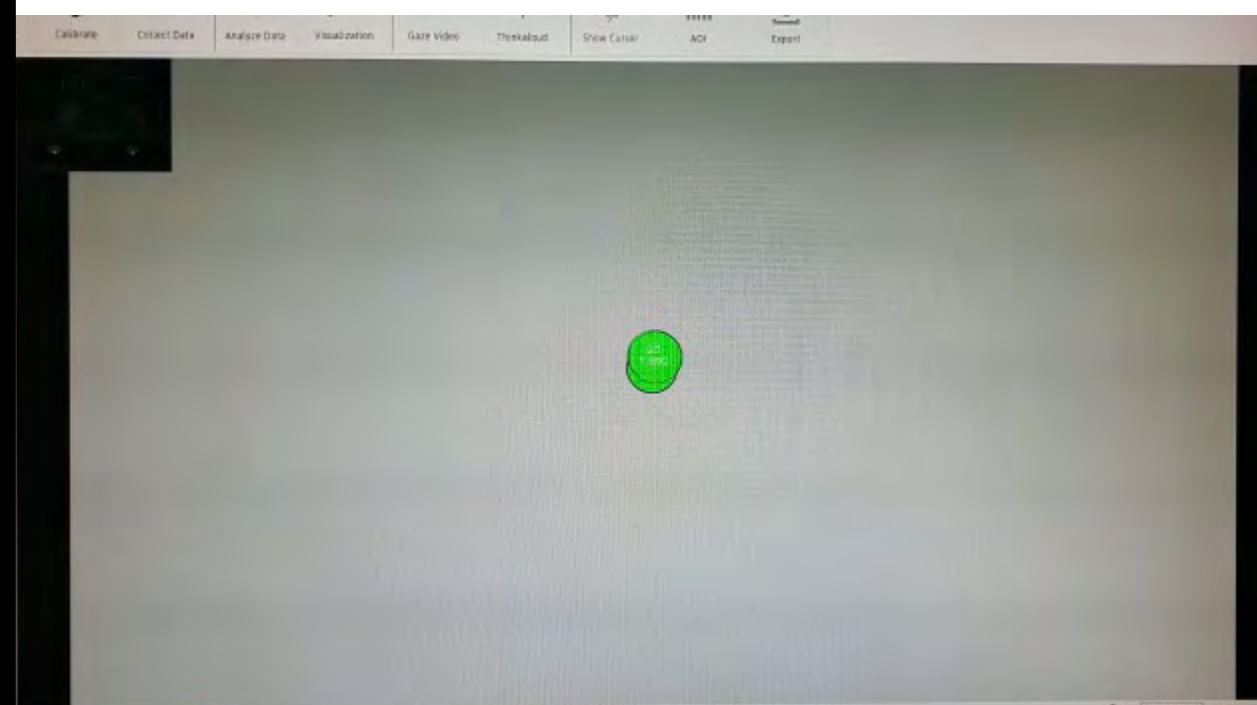
Visualization of fixations



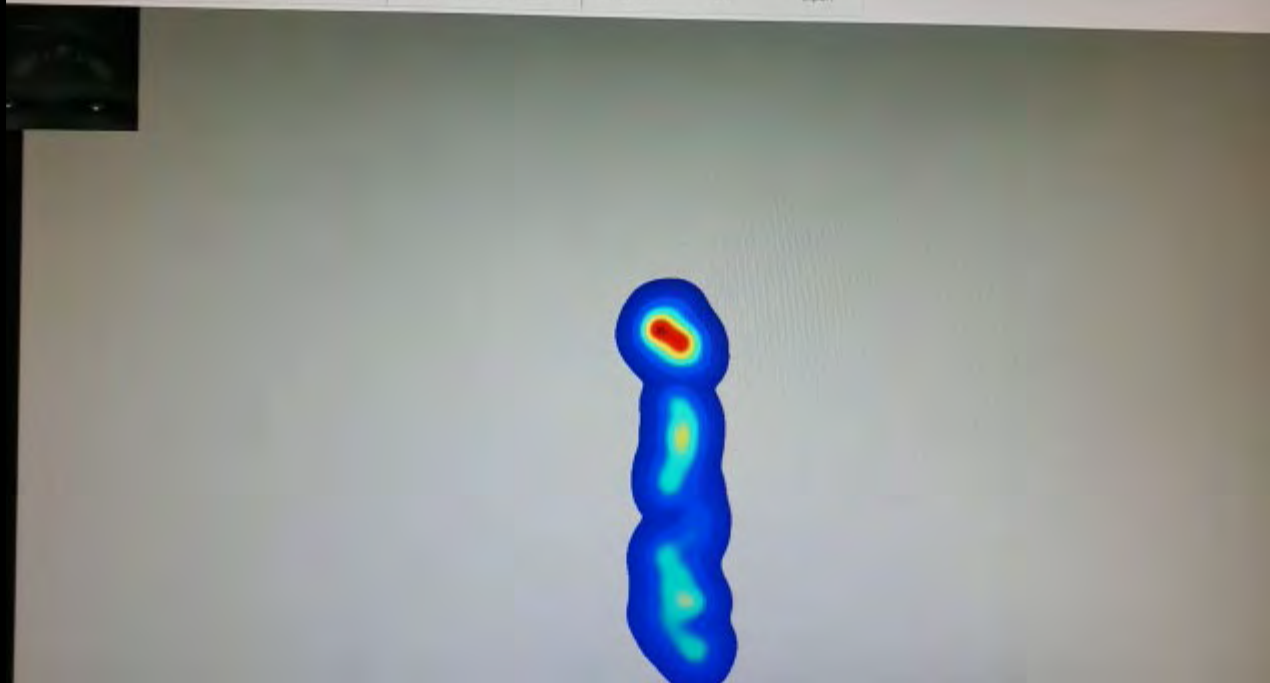
Eye tracking



Scan path



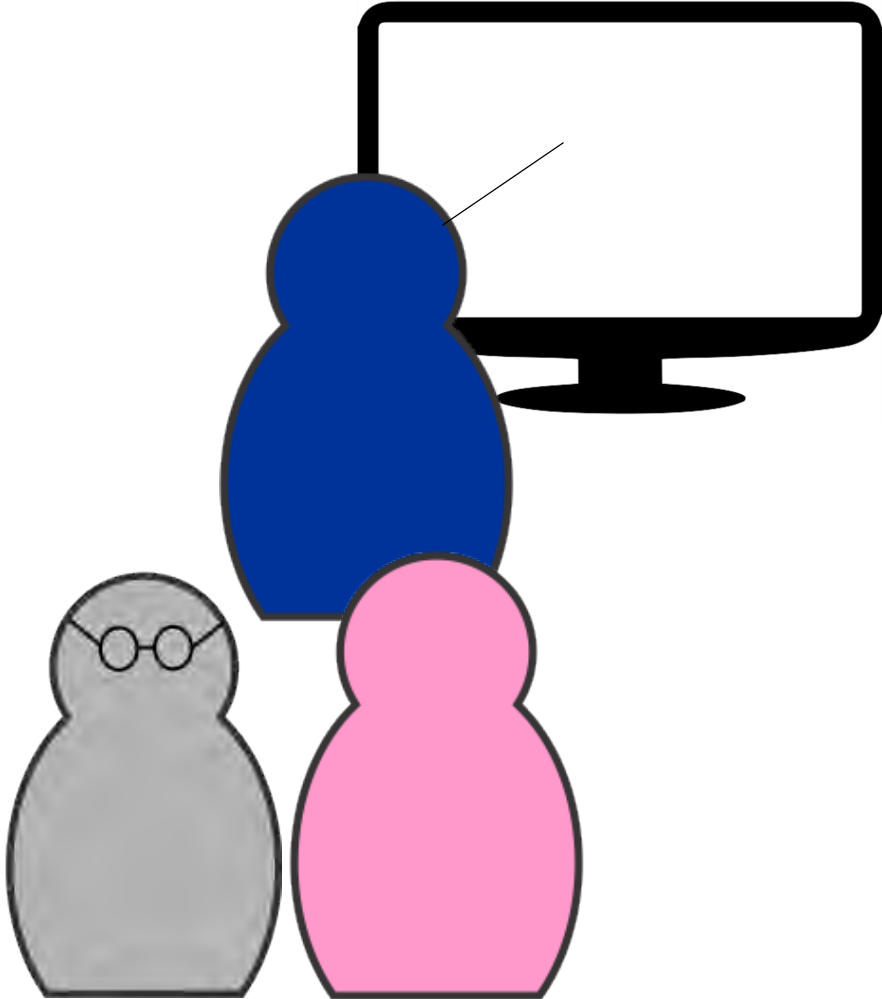
Heatmap



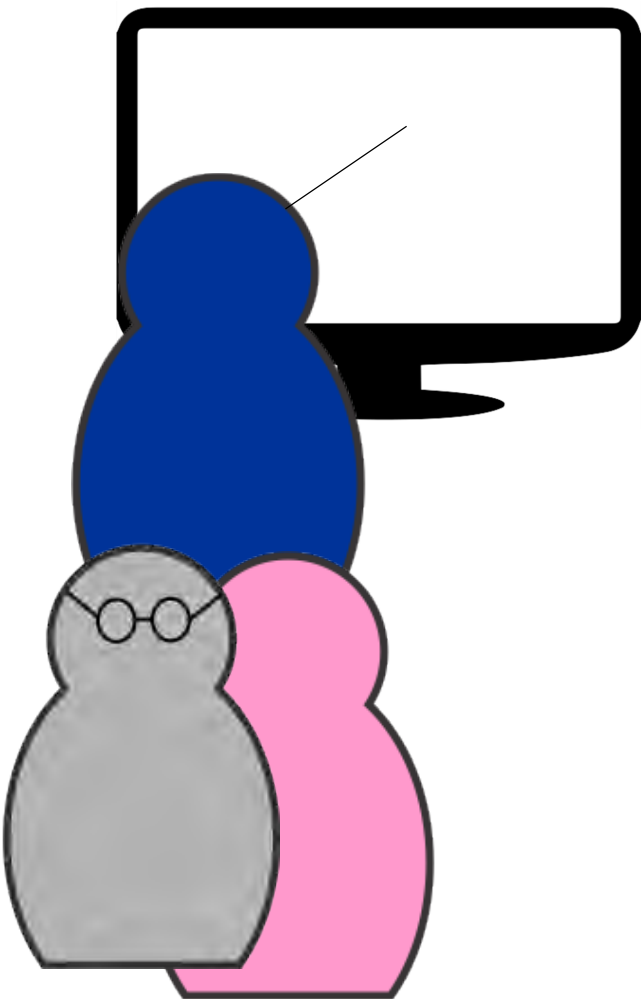


# Experiments to differentiate people with Alzheimer's disease (AD) and controls [1,2]

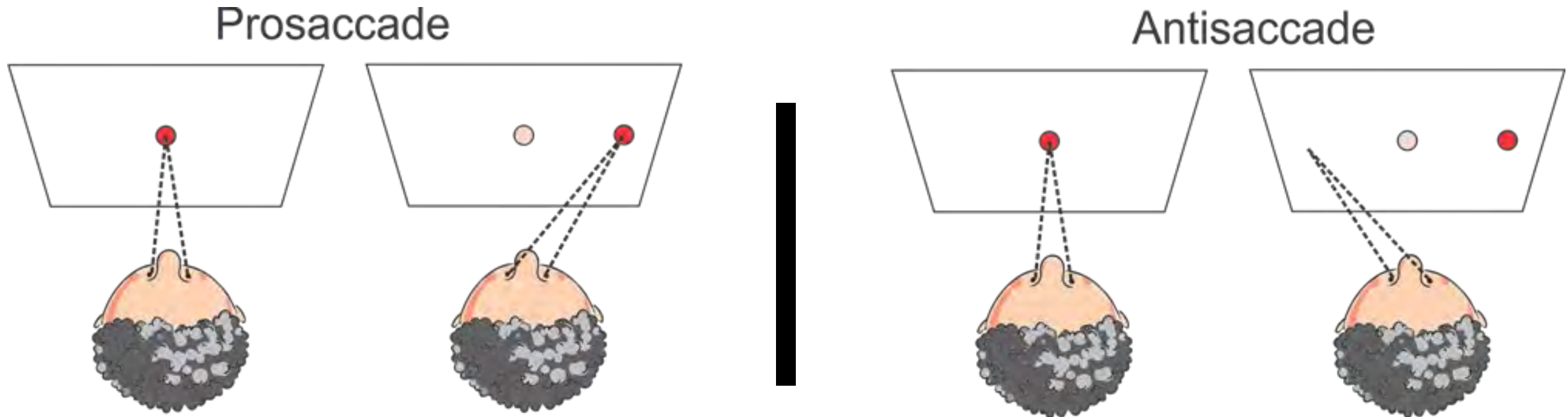
People with AD



Controls



# Prosaccade and antisaccade tests [3]



*“Several studies have reported a dysfunction in the disengagement of attention in AD which appears to coincide with the progressive decline in working memory and executive function”*

# Spotting an animal in complex pictures [4]



*It has been suggested that the anatomical pathway likely used to initiate rapid oculomotor responses in the saccadic choice task could involve the **Frontal Eye Field**, a structure that is part of the **dorsal attentional network**, in which connectivity is disrupted in AD*

# Visual Paired Comparison (VPC) Task [5,6]

Alzheimer's disease (AD) is associated with **selective attention impairments**, which could contribute to cognitive and functional deficits.

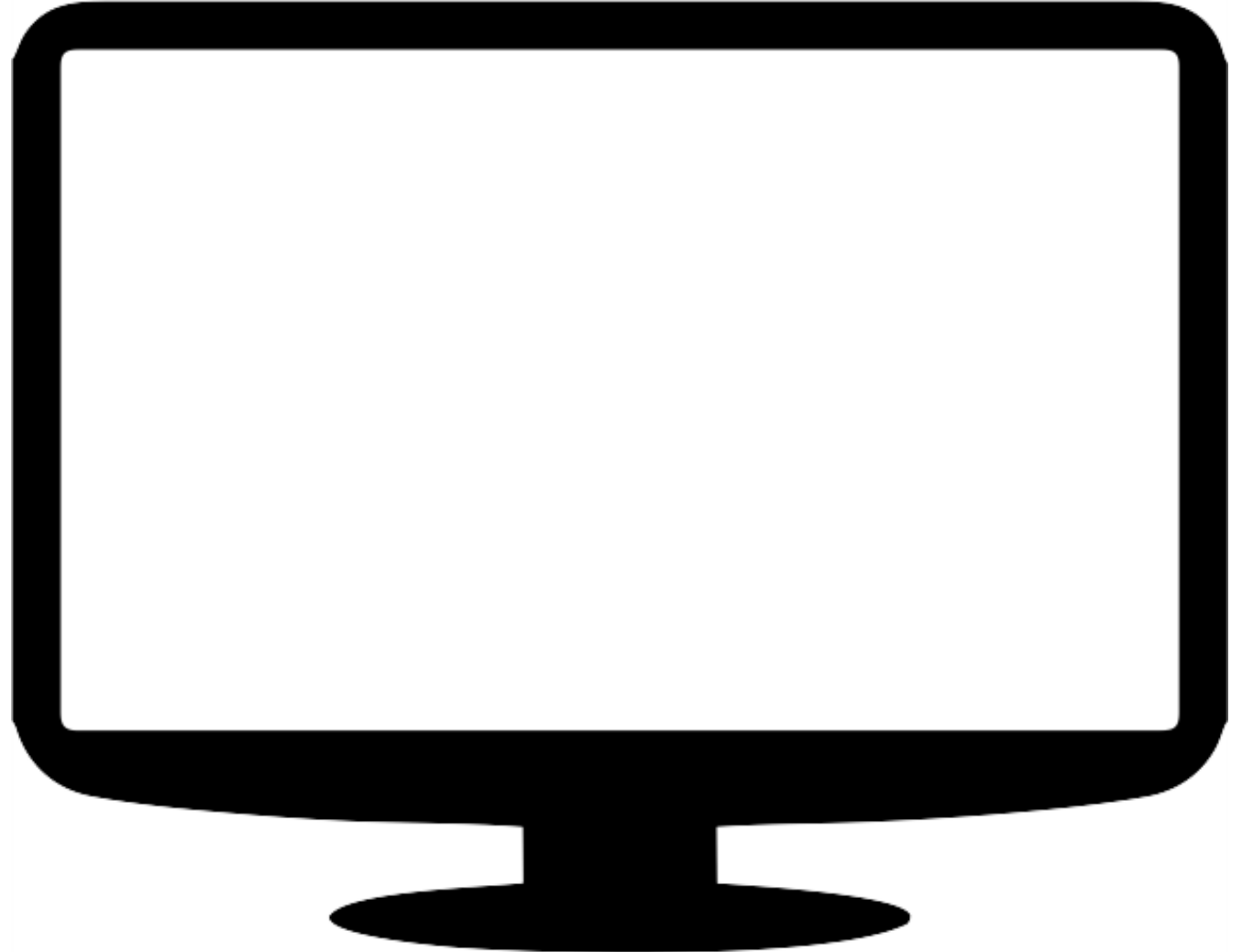
“The VPC task is a recognition **memory** task that assesses the **proportion of time** an individual spends viewing a new picture compared to a picture they have previously seen, i.e. **novelty preference**.”



# Visual Paired Comparison (VPC) Task [5,6]

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“The VPC task is a recognition **memory** task that assesses the **proportion of time** an individual spends viewing a new picture compared to a picture they have previously seen, i.e. **novelty preference**.”

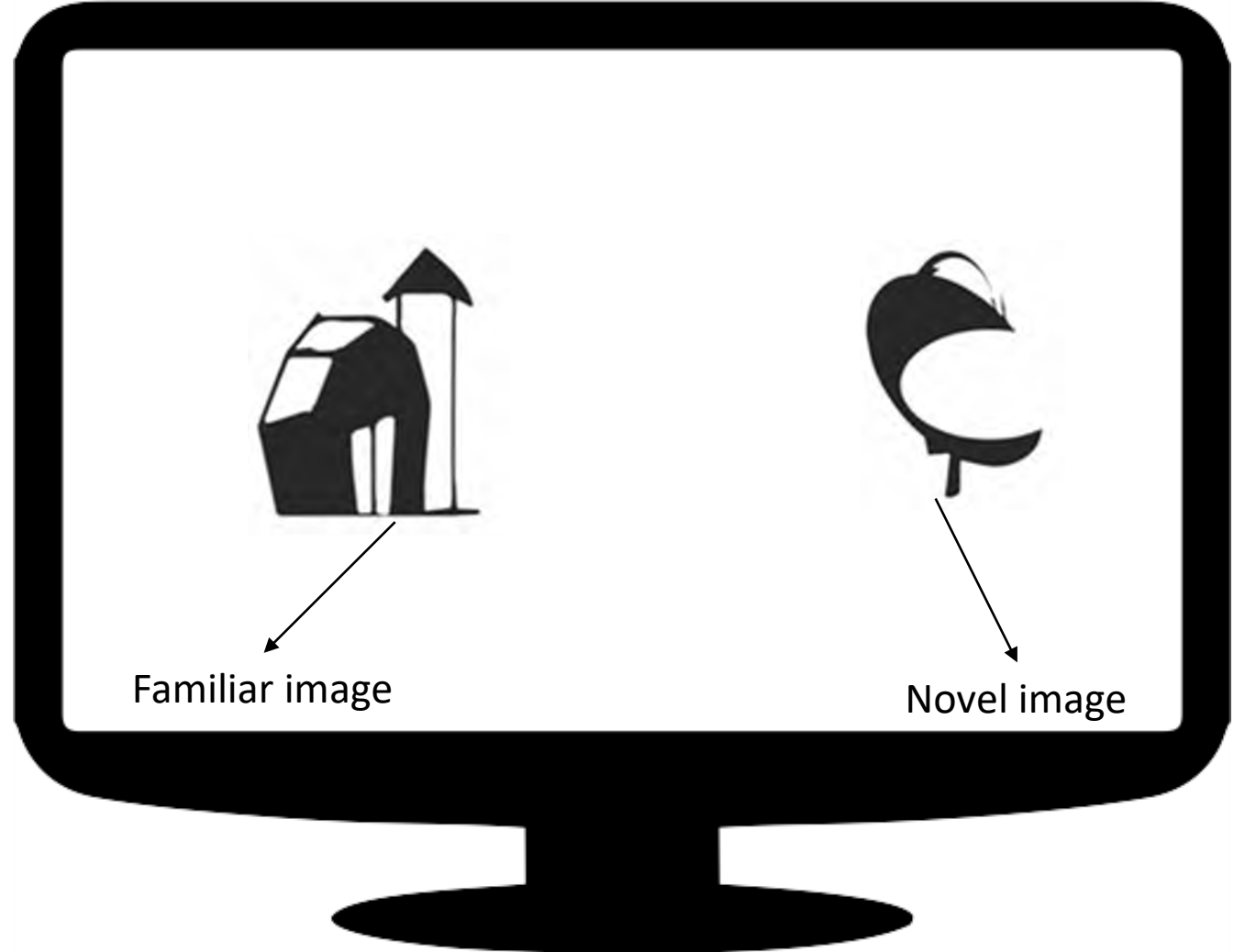


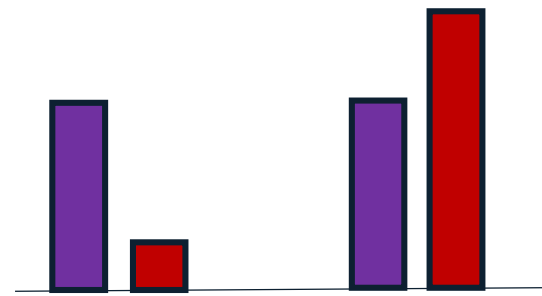
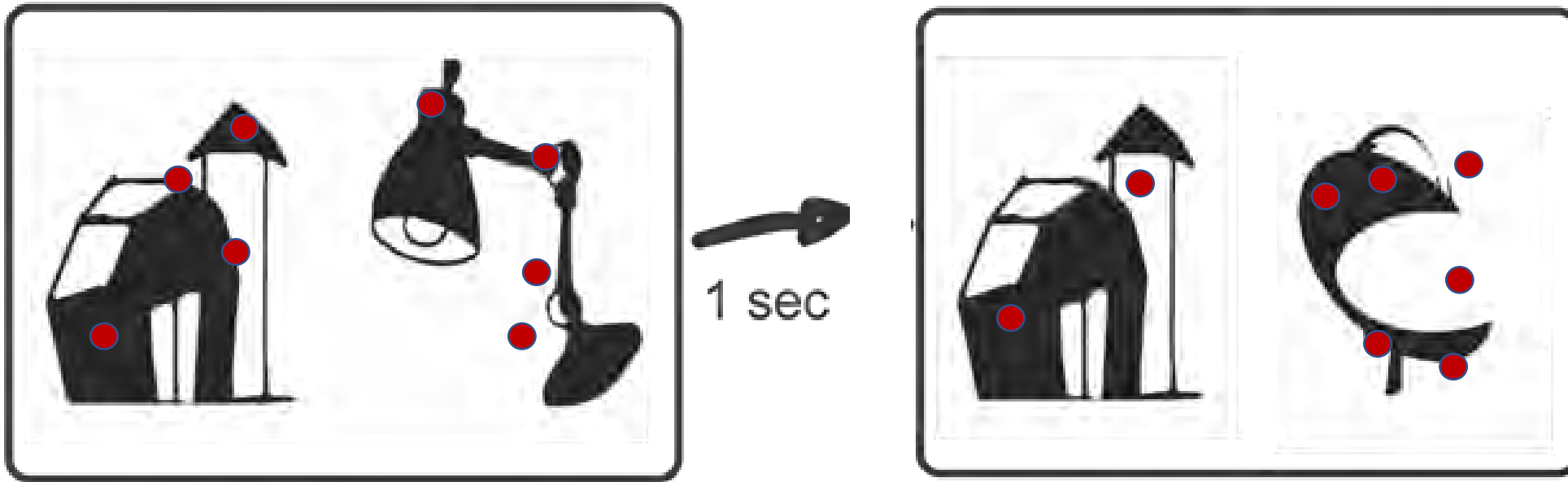


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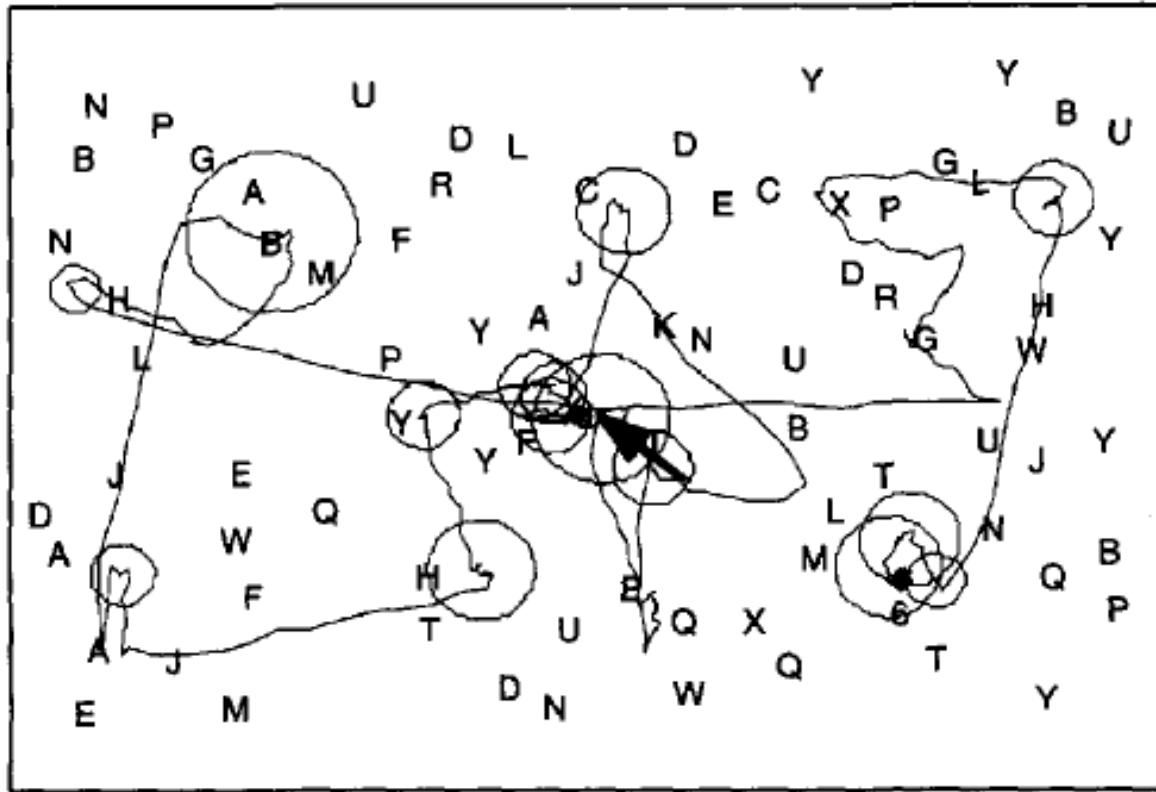




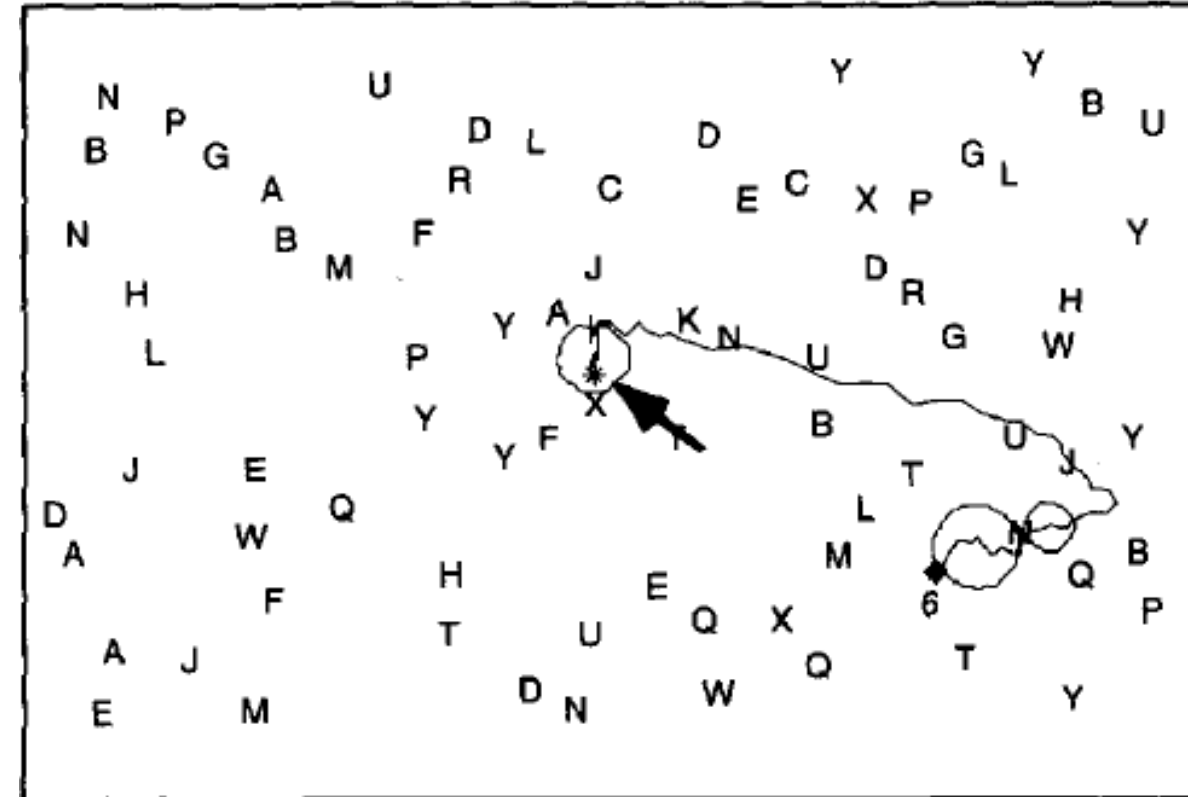
Preference to novel image

- Percentage of observation time of healthy controls.
- Percentage of observation time of people with AD.

# Alteration of visual search strategies in Alzheimer's disease [7]



AD patient



Cognitively intact

← Start

Goal Find number six

*“This qualitative difference in the architecture of visual search between AD and aging may reflect a specific deficit in the disengagement of **visual spatial attention**, a prolongation of saccade initiation, or **inefficiency in planning a search strategy**”*

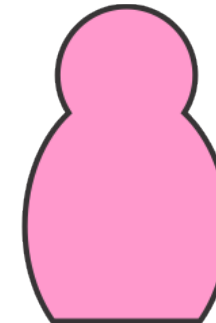
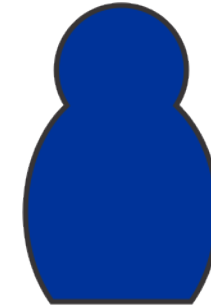


# Geriatrics and Computer Science

What can we do and what do we need?



?



# Referencias

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2. Coubard O., What do we know about eye movements in Alzheimer's disease? The past 37 years and future directions. *Biomarkers in Medicine* (2016).
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8. Jessica Beltrán, Mireya García-Vázquez, Jenny Benois-Pineau, Luis Miguel Gutiérrez-Robledo, and Jean-François Dartigues, **Computational techniques for eye movements analysis towards supporting early diagnosis of Alzheimer's disease** in Special Issue Computational Tools and Techniques for Early Diagnosis and Screening of Geriatric Diseases in Computational and Mathematical Methods in Medicine (2018).
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10. Jessica Beltrán, Isaac Ríos-Vázquez, Ámbar S. Sánchez-Cortez, René F. Navarro, Luis A. Maldonado-Cano and Mireya S. García-Vázquez , **A preliminary study using a web camera based eye tracking to assess novelty reaction allowing user interaction**, MexIHC (2018).



**Thank you!**

75  
AÑOS  
1943 - 2018

SALUD  
SECRETARÍA DE SALUD



INSTITUTO  
NACIONAL  
DE GERIATRÍA

Conocimiento y conciencia  
para un envejecimiento saludable

# Realidad Virtual: Uso terapéutico en personas mayores con demencia (RV-Demencia)

**Sara Torres-Castro**

**Investigadora en Ciencias Medicas**

**Instituto Nacional de Geriatria**

Noviembre/2018

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Mariana López Ortega, INGER (Colaboración econometría)

Teresa Álvarez Cisneros, INGER (Colaboración clínica)

### **Investigadores asociados Instituto Nacional de Neurología y Neurocirugía (INN)**

Ana Luisa Sosa Ortiz, INN (Asesoría científica y técnica)

Isaac Acosta Castillo, INN (Colaboración clínica y metodológica)

### **Colaboradores Doble once**

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Blanca Segura Pacheco, DOBLE ONCE (Colaboración tecnológica y metodológica)

Ana Luisa Esparza, DOBLE ONCE (Colaboración tecnológica y metodológica)

### **Asesores**

Luis Miguel Gutiérrez Robledo, INGER (Asesoría científica y técnica)

Ana Luisa Sosa Ortiz, INN (Asesoría científica y técnica)

Rubén Rabaneda Bueno, (Asesoría metodológica y estadística)

Every **3**

**seconds**

someone in the world develops

**dementia**



**En 2018, hay más de 50 millones de personas con demencia en el mundo**

(ADI, 2018).

En México la prevalencia de demencia es de 7.4 y 7.3% para las áreas urbana y rural (Llibre Rodríguez et al., 2008).

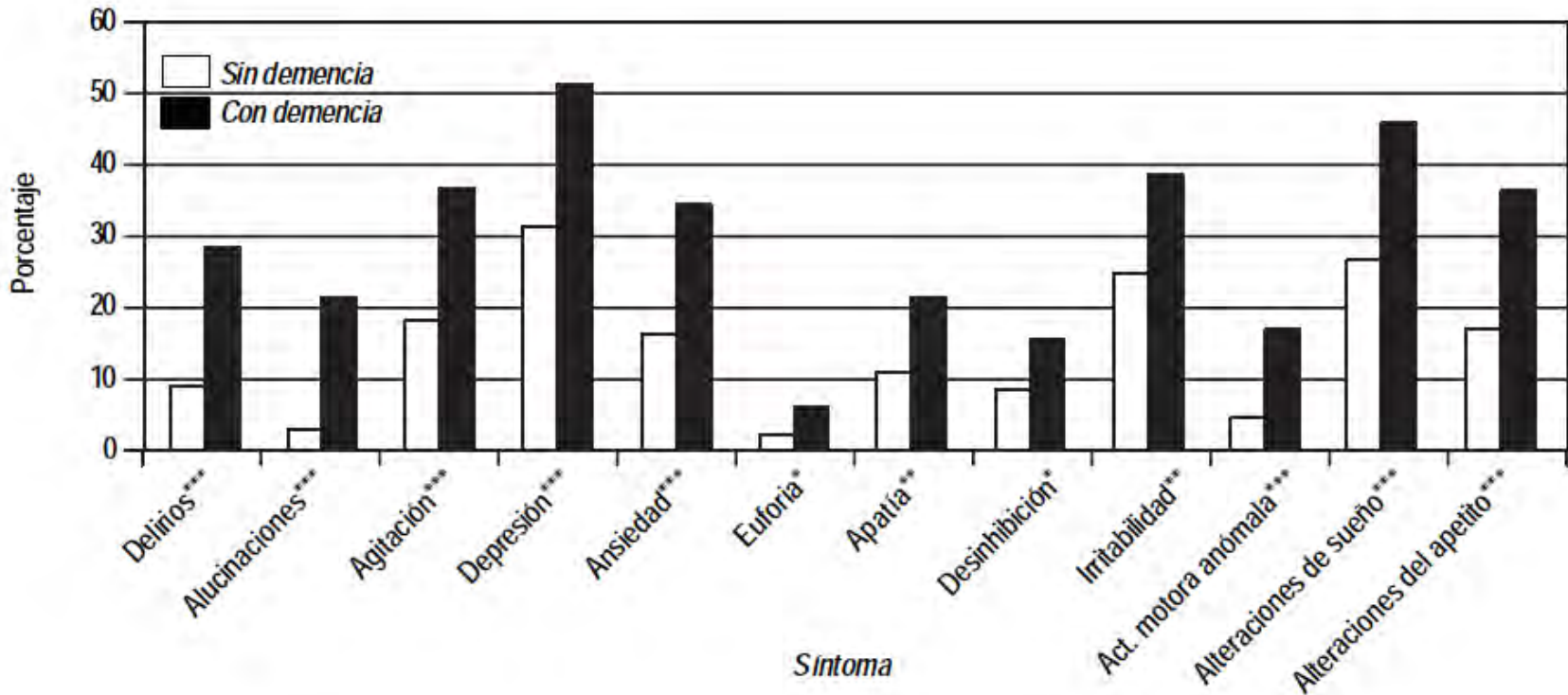


Dementia is a trillion dollar disease.  
By 2030 dementia will cost the  
global economy

**US\$ 2 trillion**

## Prevalencia de síntomas neuropsiquiátricos en AM con y sin demencia (Grupo de Investigación en Demencias 10/66 México)

A



**Síntomas neuropsiquiátricos en 88% de los casos con Alzheimer.** Relacionados con la calidad de vida, dependencia e institucionalización. (Lyketsos, 2001).



## Estudios de intervención no farmacológica

- ✓ Programas de capacitación del personal médico y de cuidados en la optimización de las prescripciones de medicamentos antipsicóticos y las intervenciones psicosociales para el tratamiento de los síntomas neuropsiquiátricos. (Whitaker et al., 2012; Fossey et al., 2016).
- ✓ En México existe un conocimiento impreciso de lo que ocurre en en las Instituciones de cuidados de largo plazo (casa hogar) (López-Ortega 2014).
- ✓ Torres-Castro S, López-Ortega M, Martínez-Ruiz A, Gutiérrez-Robledo LM, Guzmán A. Pilot study and key feasibility factors of a staff training intervention and reduction of antipsychotic prescription practice in Mexican urban care homes: study protocol. *J Ment Health Aging* 2018; **2**: 47-55.

## Terapia de reminiscencia

- Beneficios para la comunicación (Schweitzer, 2008).
- Mejora las relaciones personales entre las personas con demencia y sus cuidadores (Hoerster et al, 2001; Woods et al, 2009)



## Synthèse

Geriatr Psychol Neuropsychiatr Vieil 2017 ; 15 (1) : 65-74

# La réalité virtuelle a-t-elle un avenir pour l'étude de la mémoire épisodique dans le vieillissement ?

*Does virtual reality have a future for the study of episodic memory in aging?*

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VALENTINA LA CORTE<sup>1,2</sup>  
PASCALE PIOLINO<sup>1,2,3</sup>

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**Tirés à part :**  
P. Piolino

**Résumé.** La mémoire épisodique est la mémoire des événements personnellement vécus situés dans le temps et dans l'espace, elle façonne notre identité et nous permet de se projeter dans le temps. Cette forme de mémoire est vulnérable à l'effet de l'âge et son dysfonctionnement entravant l'autonomie du sujet peut souvent prédire l'évolution vers une maladie neurodégénérative. De ce fait, une meilleure compréhension de ce type de mémoire est une priorité dans le domaine de la santé publique. Toutefois, la plupart des outils d'évaluation sont souvent décontextualisés n'offrant qu'une mesure partielle de cette capacité mnésique complexe. De nos jours une nouvelle technologie utilisant la réalité virtuelle (RV) permet d'immerger les sujets dans des simulations de situations réelles riches en contexte spatial et temporel. De par ses nombreuses caractéristiques, la RV permet de résoudre plusieurs limites des tests traditionnels. Le but de la présente synthèse est d'exposer les travaux qui ont investigué la mémoire épisodique dans le vieillissement normal et la maladie d'Alzheimer à l'aide de la RV afin d'adresser sa pertinence en tant que nouvel outil dans les pratiques futures de la neuropsychologie du vieillissement.

**Mots clés :** mémoire épisodique, vieillissement normal, maladie d'Alzheimer, réalité virtuelle



# Is it possible to use highly realistic virtual reality in the elderly? A feasibility study with image-based rendering

This article was published in the following Dove Press journal:  
Neuropsychiatric Disease and Treatment  
3 March 2015  
[Number of times this article has been viewed](#)

Michel Benoit<sup>1,2</sup>  
Rachid Guerchouche<sup>3</sup>  
Pierre-David Petit<sup>1</sup>  
Emmanuelle Chapoulie<sup>3</sup>  
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<sup>1</sup>EA CoBTeK/IA, University of Nice Sophia Antipolis, <sup>2</sup>Clinique de Psychiatrie, Pole des Neurosciences Cliniques, CHU de Nice, <sup>3</sup>Institut National de Recherche en Informatique et en Automatique, Sophia-Antipolis, <sup>4</sup>Centre Mémoire de Ressources et de Recherche, CHU de Nice, Nice, France

**Background:** Virtual reality (VR) opens up a vast number of possibilities in many domains of therapy. The primary objective of the present study was to evaluate the acceptability for elderly subjects of a VR experience using the image-based rendering virtual environment (IBVE) approach and secondly to test the hypothesis that visual cues using VR may enhance the generation of autobiographical memories.

**Methods:** Eighteen healthy volunteers (mean age 68.2 years) presenting memory complaints with a Mini-Mental State Examination score higher than 27 and no history of neuropsychiatric disease were included. Participants were asked to perform an autobiographical fluency task in four conditions. The first condition was a baseline grey screen, the second was a photograph of a well-known location in the participant's home city (FamPhoto), and the last two conditions displayed VR, ie, a familiar image-based virtual environment (FamIBVE) consisting of an image-based representation of a known landmark square in the center of the city of experimentation (Nice) and an unknown image-based virtual environment (UnknoIBVE), which was captured in a public housing neighborhood containing unrecognizable building fronts. After each of the four experimental conditions, participants filled in self-report questionnaires to assess the task acceptability (levels of emotion, motivation, security, fatigue, and familiarity). CyberSickness and Presence questionnaires were also assessed after the two VR conditions. Autobiographical memory was assessed using a verbal fluency task and quality of the recollection was assessed using the "remember/know" procedure.

**Results:** All subjects completed the experiment. Sense of security and fatigue were not significantly different between the conditions with and without VR. The FamPhoto condition yielded a higher emotion score than the other conditions ( $P < 0.05$ ). The CyberSickness questionnaire showed that participants did not experience sickness during the experiment across the VR conditions. VR stimulates autobiographical memory, as demonstrated by the increased total number of responses on the autobiographical fluency task and the increased number of conscious recollections of memories for familiar versus unknown scenes ( $P < 0.01$ ).

**Conclusion:** The study indicates that VR using the FamIBVE system is well tolerated by the elderly. VR can also stimulate recollections of autobiographical memory and convey familiarity of a given scene, which is an essential requirement for use of VR during reminiscence therapy.

→ Video abstract



J. Phys. Ther. Sci. 29: 1283–1286, 2017

## The Journal of Physical Therapy Science



### Original Article

# The effect of virtual reality program on the cognitive function and balance of the people with mild cognitive impairment

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**Abstract.** [Purpose] The purpose of this study was to investigate the effects of a virtual reality (VR) program on cognitive function and balance in the elderly with mild cognitive impairment (MCI) attending G welfare center in Gurye. [Subjects and Methods] Twenty-four patients with MCI were studied. The patients were exposed to the VR program for 30 min per experiment, which was conducted 20 times for four weeks. [Results] The cognitive function and balancing ability of the experimental group, when compared to the control group, showed a statistically significant increase in Visual Span Test (VST), Word Color Test (WCT), and Limit of Stability (LOS), which are the sub-categories of CNT 4.0, after the exposure to the program. In all test categories, the experimental group exhibited statistically significant differences compared to the control group. [Conclusion] Thus, the VR program is an effective intervention for the elderly with MCI.

**Key words:** Virtual reality program, Cognitive function, Mild cognitive impairment

*(This article was submitted Jan. 23, 2017, and was accepted May 9, 2017)*



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# ¿Qué es y qué implica la realidad virtual?



# Definiciones de **RV**

<p>Regenbrecht et al., 1998; Rizzo et al., 1998)."</p>	<p>El usuario experimenta tanto estímulos visuales como auditivos que ayudan a "sumergir" al individuo en la realidad generada por ordenador y crea el sentido de la presencia dentro del entorno.</p>
<p>Schneider, S. M., Prince-Paul, M., Allen, M. J., Silverman, P., &amp; Talaba, D. (2004)</p>	<p>La <b>RV</b> es una técnica simulada por ordenador que permite a individuos oír y sentir los estímulos que están en correspondencia con una imagen visual, utilizando un dispositivo que proyecta una imagen con el acompañamiento de sonidos.</p>
<p>Gershon, J., Zimand, E., Pickering, M., Rothbaum, B. O., &amp; Hodges, L. (2004).</p>	<p>La realidad virtual (<b>RV</b>) es un medio relativamente nuevo sobre interacciones humano-computadora por la cual el humano se convierte en un participante activo en un mundo virtual.</p>
<p>Schneider, S. M., &amp; Hood, L. E. (2007)</p>	<p>Una interfaz avanzada que permite al usuario 'actuar recíprocamente' con y 'sumergirse' dentro de un entorno generado por computadora.</p>
<p>Benoit, M., Guerchouche, R., Petit, P. D., Chapoulie, E., Manera, V., Chaurasia, G., ... &amp; Robert, P. (2015).</p>	<p>La realidad virtual (RV), definida como un entorno simulado por ordenador que puede proporcionar la sensación de presencia física en sitios que representan mundos verdaderos o imaginados.</p>

# Definiciones de **RV**

**García-Betances, R. I., Jiménez-Mixco, V., Arredondo, M. T., & Cabrera-Umpiérrez, M. F. (2015).**

**La realidad virtual es fundada sobre varios componentes de percepción psicofísica, principalmente visuales, táctiles y sensaciones kinestésicas. El empleo de sistemas **RV** ofrece la posibilidad de simular escenarios inmersivos e interactivos de la vida real para producir una sensación "de ser allí."**

Manera, V., Chapoulie, E., Bourgeois, J., Guerchouche, R., David, R., Ondrej, J., ... & Robert, P. (2016).

Los sistemas **RV** totalmente inmersivos consisten en demostraciones 3D que prácticamente colocan al paciente dentro del entorno virtual al nivel más alto de inmersión.

Abichou, K., La, V. C., & Piolino, P. (2017).

Es una tecnología que ofrece la oportunidad de sumergir al usuario en un entorno 3D generado por un ordenador y en el que puede interactuar gracias a la utilización de interfaces sensoriomotrices.

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# Propuesta de Investigación 2019-2020

Estudio de reminiscencia con realidad virtual para reducir síntomas psicológicos y conductuales en personas con demencia en instituciones de larga estancia en México (**RV-Demencia**)

No existen estudios en México de **RV** con reminiscencia como un proceso terapéutico en personas con demencia y como un recurso de apoyo para los cuidadores.

Es una opción de tratamiento no farmacológico innovador para el tratamiento de **síntomas neuropsiquiátricos, estimulación de memoria autobiográfica y mejora de la calidad de vida.**



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# Objetivo

Evaluar la utilidad de la terapia de reminiscencia con **RV** y su posible efecto en síntomas psicológicos y conductuales en personas con demencia en instituciones de larga estancia.

# Metodología

## Diseño:

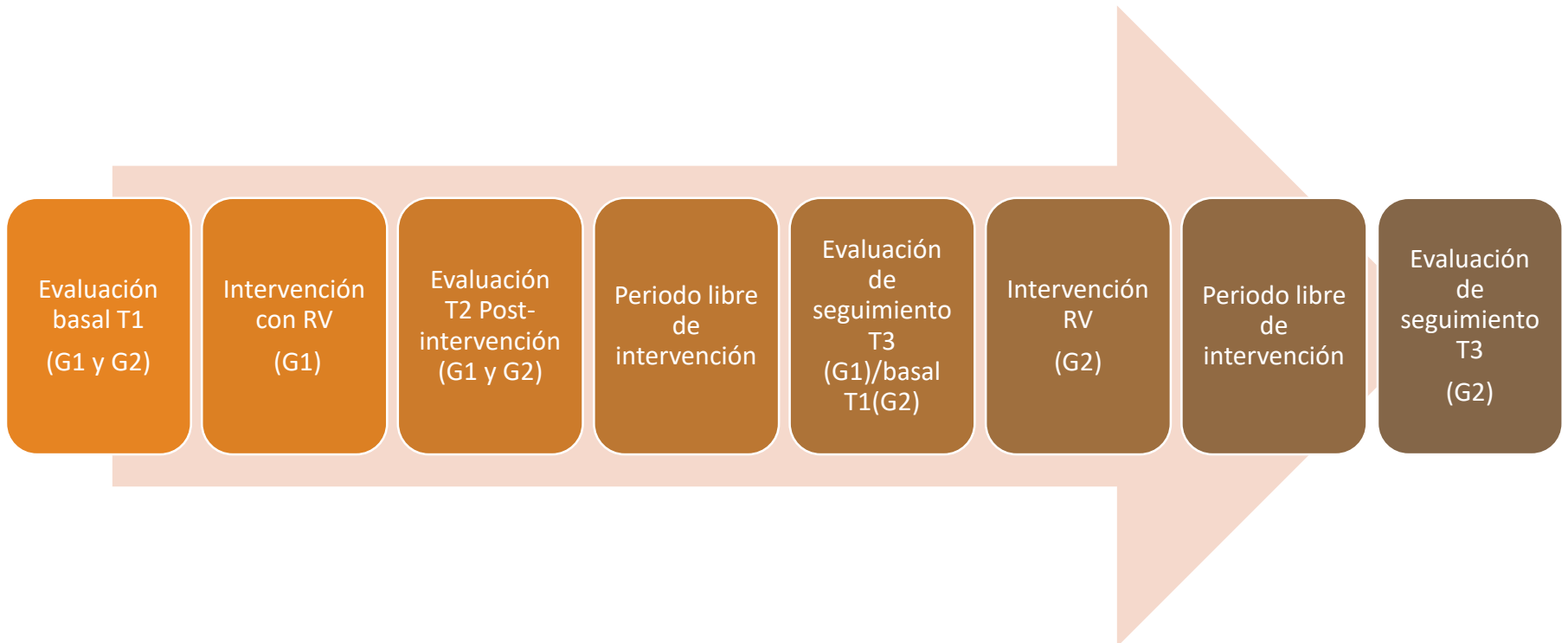
**Ensayo comunitario:** Ensayo clínico en comunidades o poblaciones (8 Residencias)

**Aleatorizado:** la asignación de las Residencias se realizará de manera aleatoria.

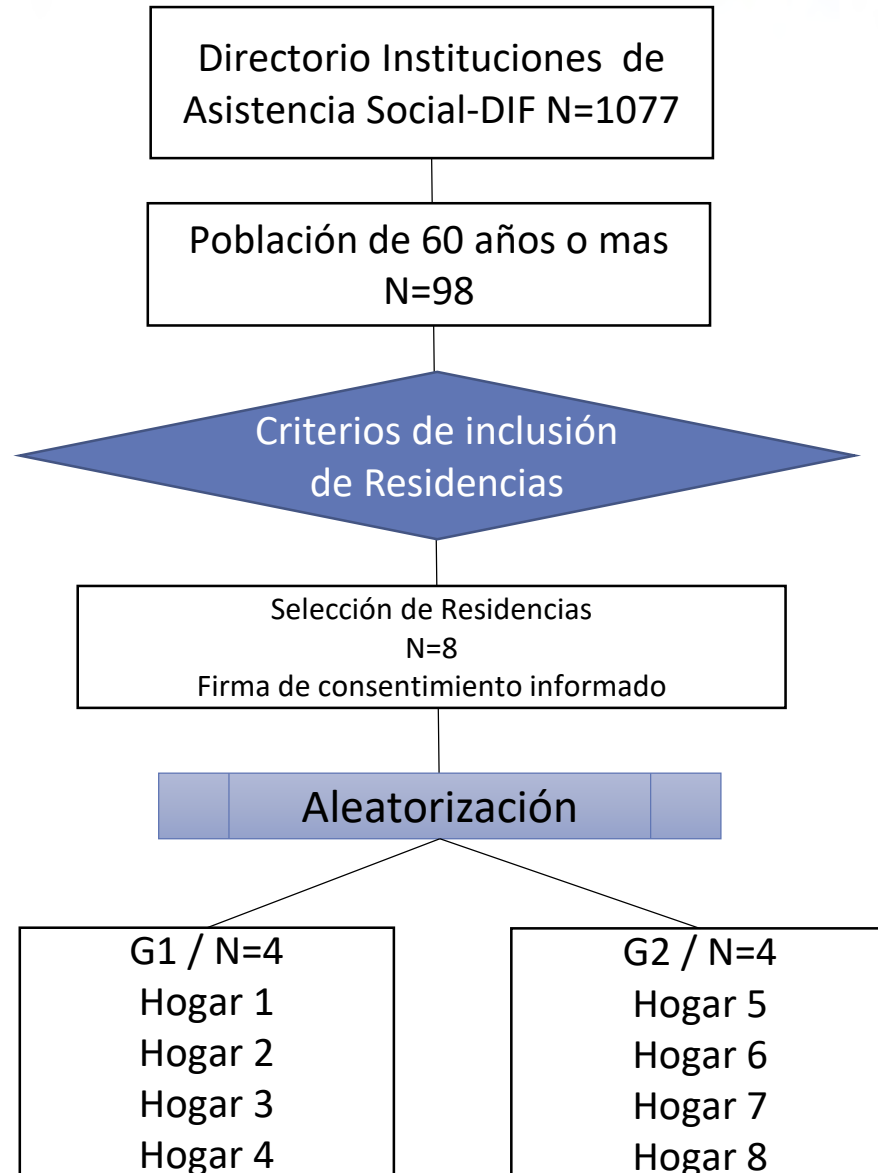
**Controlado:** G1 -Grupo intervención con RV y G2 -Grupo control (Tratamiento habitual e intervención)

**Cruzado:** Los dos grupos reciben el tratamiento en diferente tiempo 2:1

**Doble ciego:** Evaluador e investigador que analiza los datos ignoran quien recibe la intervención.



## Selección de las Residencias



- 1) Residencias con una población mayor a 50 residentes
- 2) 20% de los residentes con sospecha de demencia (se realizará tamizaje con escala de minimal).
- 3) Que cuenten con un médico de cabecera y un protocolo de emergencias médicas.
- 4) Que tengan acceso a un psicólogo que atienda las crisis emocionales.
- 5) Residencias que no formen parte de un protocolo semejante y no lleven a cabo reminiscencias.

## Intervenciones con realidad virtual

- La intervención consta de 12 sesiones de reminiscencia con RV
- 12 videos, con temas neutros previamente validados por expertos.
- Videos con duración de 15 a 20 minutos
- Durante 6 semanas (dos sesiones por semana)
- Sesiones individuales
- Espacio designado para la terapia
- Psicólogo y técnico en RV



## Prueba en grupo de voluntarias (Personas mayores sin demencia)





## Prueba en grupo de voluntarias (Personas mayores sin demencia)



# Prueba de equipo y contenido



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# Experiencia persona 1





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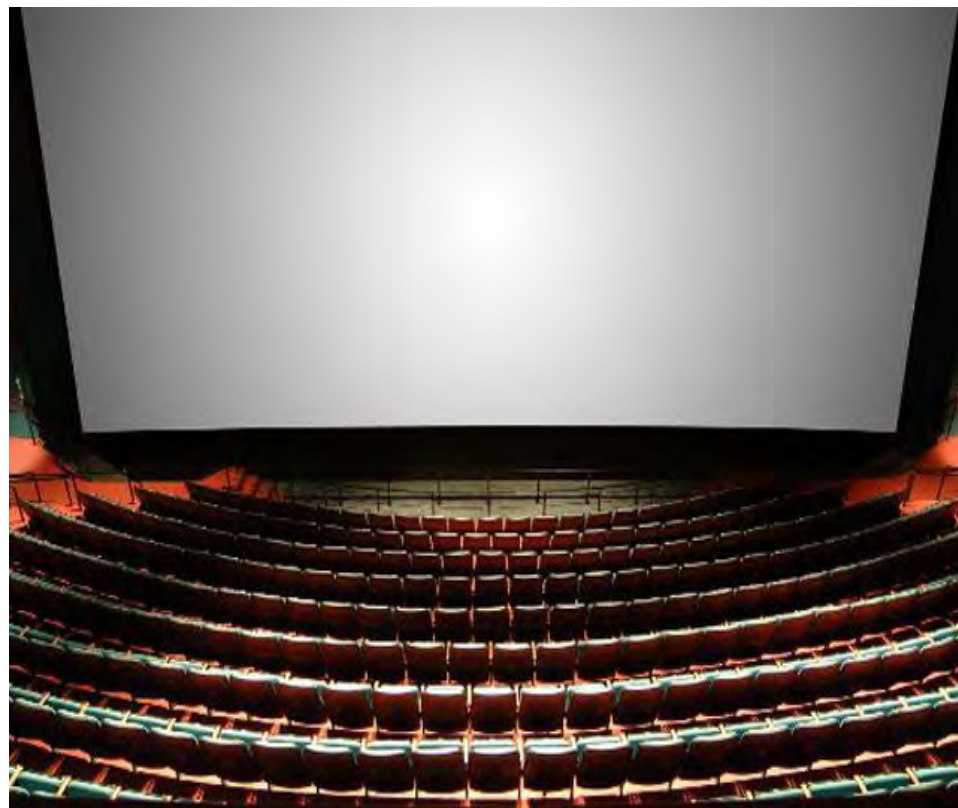
# Experiencia persona 2



# Elementos de la **RV**



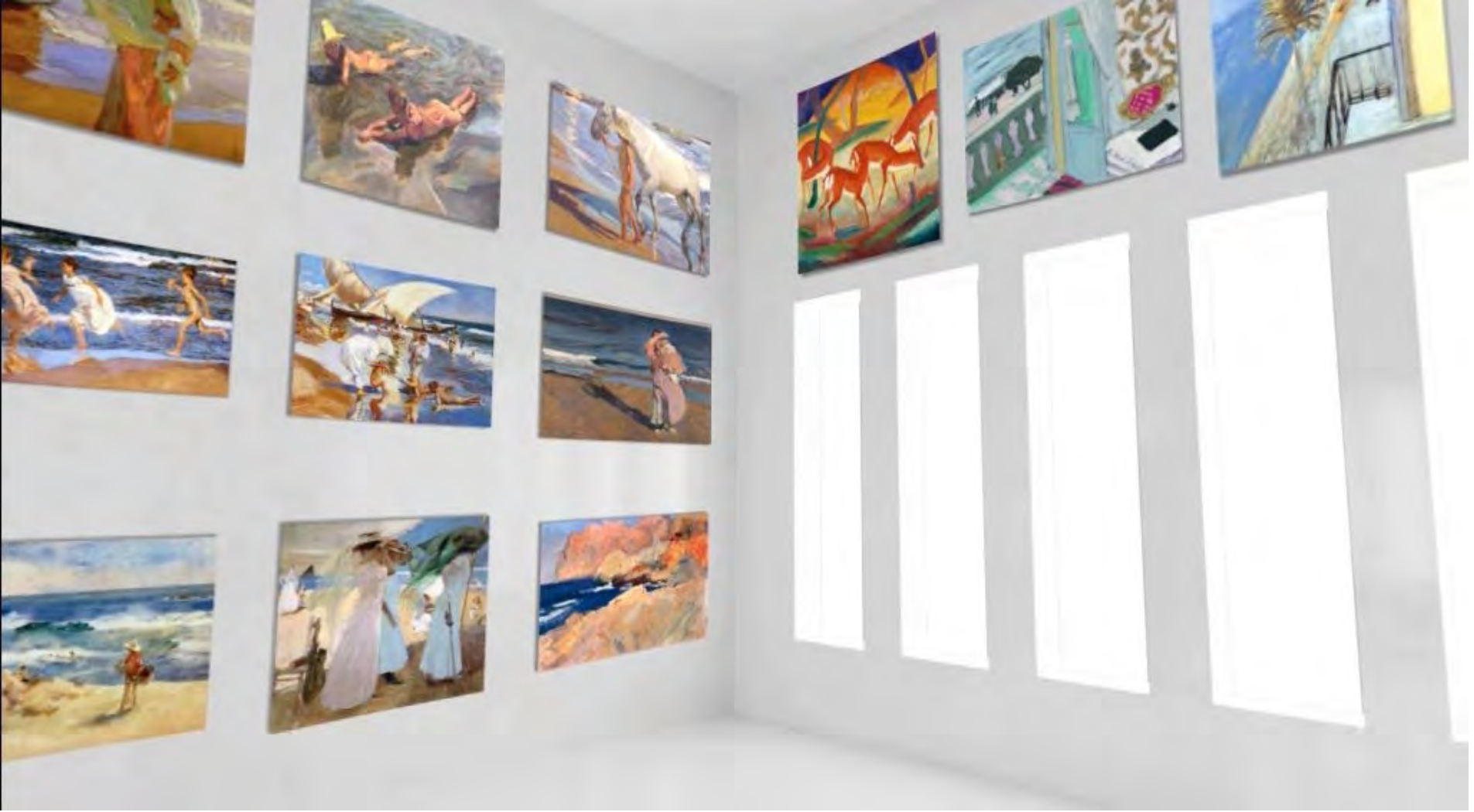
Nivel máx. interacción  
(sujeto activo/protagonismo)



Nivel mín. interacción  
(sujeto pasivo)









## Donde estamos?

- Protocolo terminado para evaluación de Comité de ética e investigación.
- Estamos preparando los diferentes convenios de colaboración
- Doble once esta trabajando en los videos
- Desarrollo del Manual de terapia de reminiscencia.
- Visitando y seleccionando las residencias candidatas.
- Reclutamiento de psicoterapeutas
- Solicitud de financiamiento en CONACYT
- Propuesta enviada a FUNSALUD



¡Gracias!



# Monitoring People by Video Analysis

**Monique Thonnat, DR INRIA**  
***STARS, Sophia Antipolis France***

# Plan

---

## Activity recognition:

- A new Hybrid Architecture for Human Activity Recognition from RGB-D Videos [MMM2019]

## Clinical:

- An Approach with Serious Exergames for Assessment and Stimulation of Patients with Neurocognitive Disorders [ISG 2018]



# A new Hybrid Architecture for Human Activity Recognition from RGB-D videos

S. Das, M. Thonnat, K. Sakhalkar, M Kopershi, F. Bremond  
Inria and G. Francesca Toyota

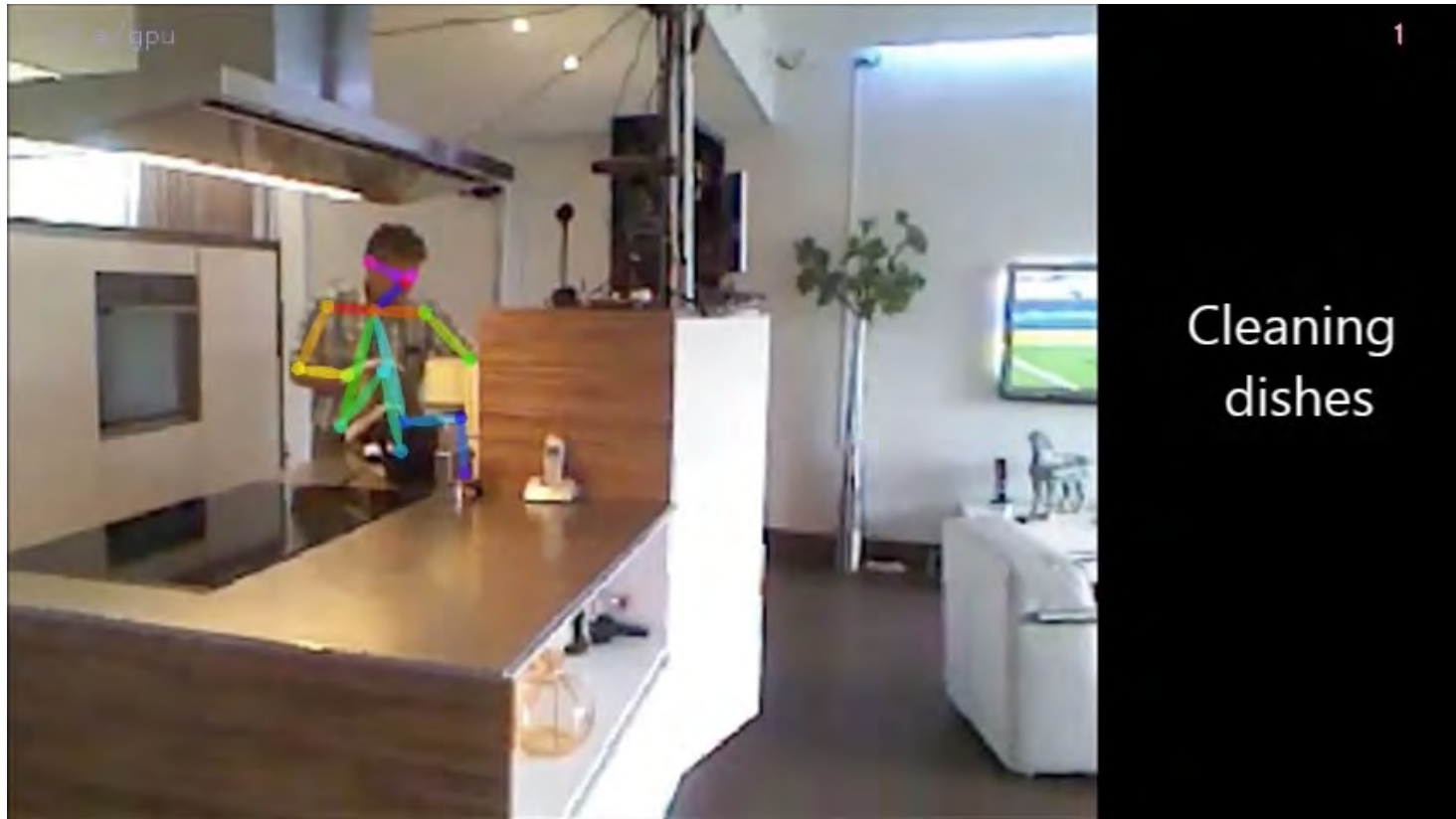
# Introduction

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## Objectives:

- Focus on Activities of Daily Living (*smarthome, nursing home, clinical setting...*)
- RGB-D videos of short actions (*color + depth camera*)
- Real-time Action Recognition (*fully automated, robust, fast*)

# Introduction





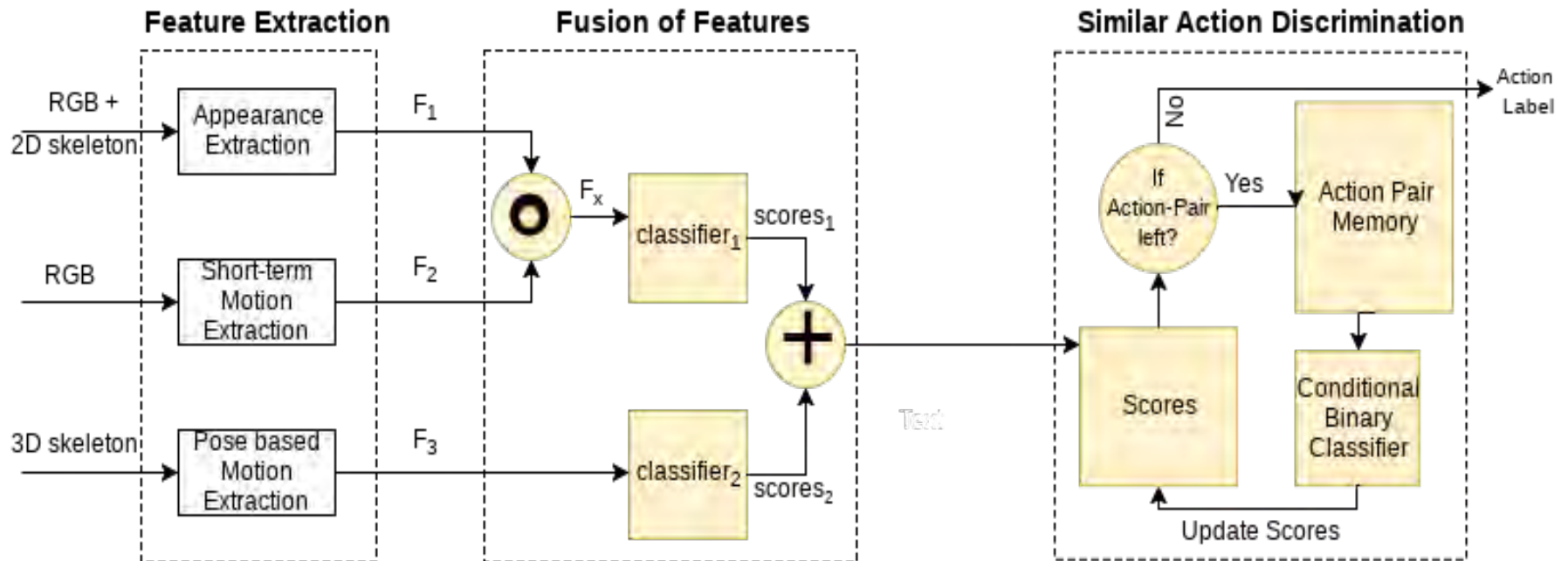
# Approach

## Method:

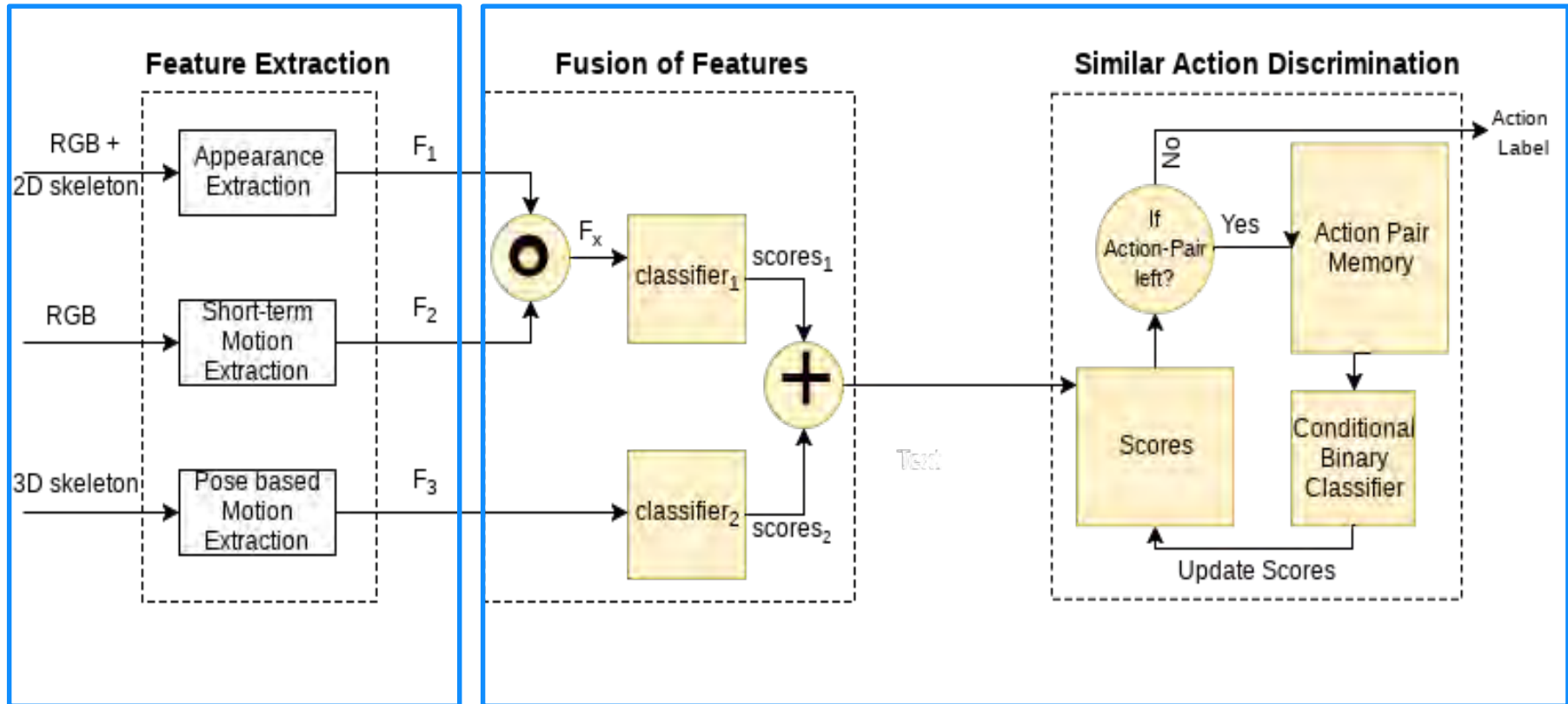
a new Architecture mixing a high level Fusion Strategy and Machine Learning techniques:

- **Feature extraction** from different cues (appearance, motion, pose) using local descriptors or deep neural networks
- **Fusion strategy:** low level fusion of appearance and short-term motion then high level fusion with 3D pose dynamics
- **Action recognition:** SVM classifiers + similar action discrimination learning

# Approach



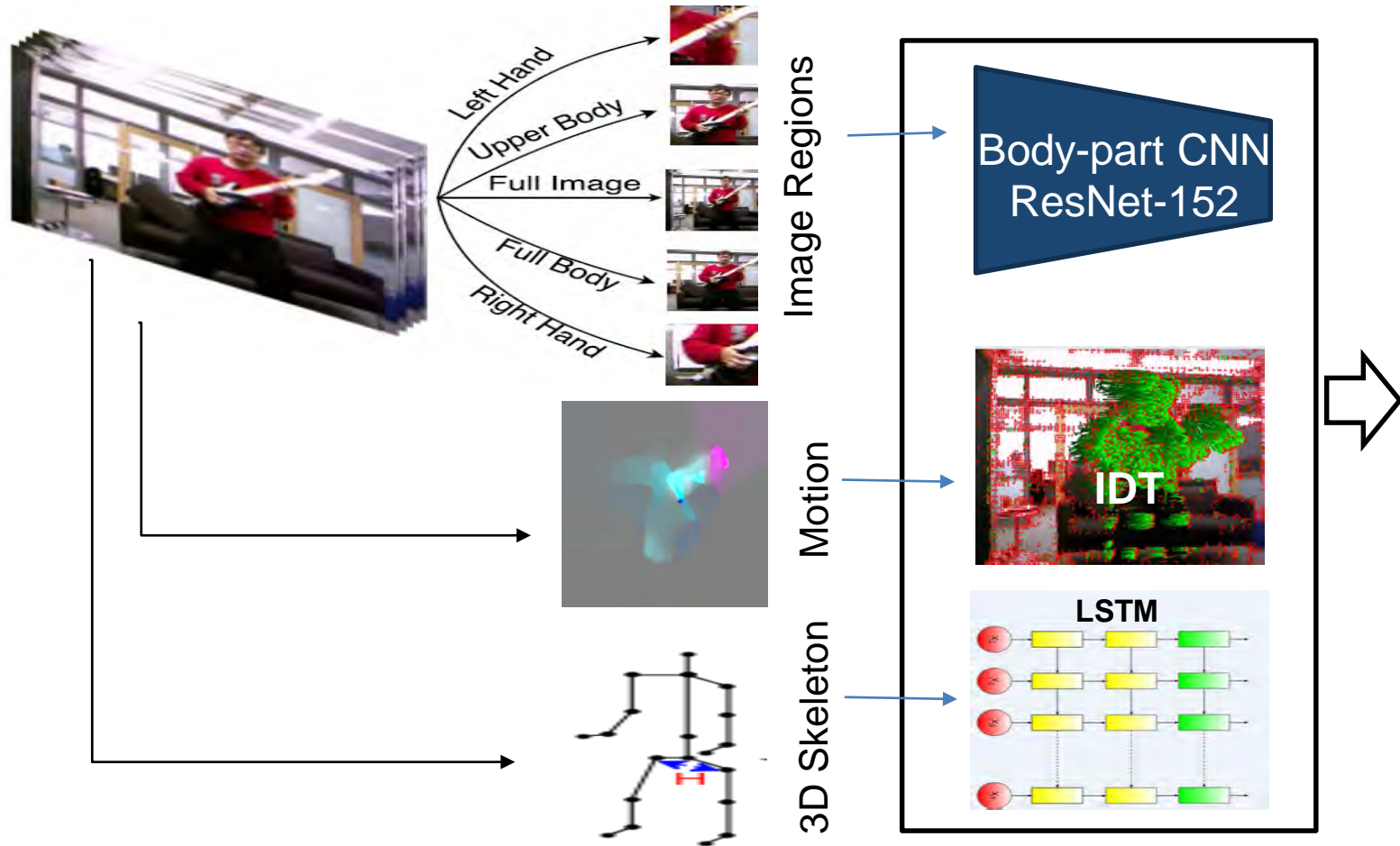
# Approach



Dense trajectories,  
CNN or RNN

High level strategy + SVM classifiers

# Approach: Feature extraction



# Approach

## Fusion strategy:

**Class score  $s$ :**  $s = \alpha \text{score}(F_x) + (1 - \alpha) \text{score}(F_3)$

With  $F_x$  = low level fusion of appearance and short-term motion features

$F_3$  = 3D pose dynamics features

Class score( $F$ ) computed by SVM classifier from feature  $F$

## Similar action discrimination:

1) Similar action pairs building:

Let  $C$  the confusion matrix:

If  $C(i,j) + C(j,i) \geq \varepsilon$   $i \neq j$  then action  $i$  and  $j$  are stored

2) Conditional binary classifiers trained for all action pairs

## Implementation:

Appearance: 2D CNN ResNet-152 or 3D CNN I3D if large training datasets,

Motion: dense trajectories toolbox, Pose-based dynamics: LSTM with TensorFlow

scikit-learn for SVM classifiers



# Experiments

**Public Databases:** clipped videos of short ADL actions

**CAD-60:** 60 RGB-D videos, 4 subjects, 14 actions

**CAD-120:** 120 RGB-D videos, 4 subjects, 10 high level actions

**MSRDaily-Activity3D:** 320 RGB-D videos, 10 subjects, 16 actions

**NTURGB+D:** 56880 RGB-D videos, 40 subjects, 60 actions

**Hyper-Parameters:**

- value of score fusion parameter  $\alpha$  learned during training
- handcrafted similar-action pairs parameter  $\epsilon$   
*ranges from 0.1 (NTU) to 0.44 (CAD-120)*

**Runtime:**

- Additional cost of 10 ms per frame on single CPU w.r.t feature extraction

# Experiments: data sets

CAD 60



CAD 120



MSRDailyActivity3D



NTU RGB+D



# Experiments

Skeleton Detection using Pose Machines



Skeleton Detection using Kinect



Action Label - Drinking

# Experiments

Stacking Objects  
Rec. Acc. - 50 %



## Comparison with the state-of-the-art

Methods on CAD-60	Accuracy [%]
Object Affordance (Kopulla et al.)	71.40
HON4D (Oreifej et al.)	72.70
Action Ensemble (Wu et al.)	74.70
MSLF (Koperski et al.)	80.36
JOULE-SVM (Hu et al.)	84.10
Fusion P-CNN [Das et al.]	95.58
<b>Proposed Method</b>	<b>98.52</b>

Methods on MSRDailyActivity3D	Accuracy [%]
Actionlet Ensemble (Wu et al.)	85.80
RGGP + Fusion (Liu et al.)	85.60
MSLF (Koperski et al.)	85.95
DCSF + joint (Xia et al.)	88.20
JOULE-SVM (Hu et al.)	95.00
Range Sample (Lu et al.)	95.60
DSSCA-SSLIM (Shahroudy et al.)	97.50
<b>Proposed Method</b>	<b>97.81</b>



## Comparison with the state-of-the-art

Methods on CAD-120	Accuracy [%]
Salient Proto-Objects (Rybok et al.)	78.20
TDD (Wang et al.)	80.38
SVM + CNN (Lin et al.)	78.30
STS (Kopulla et al.)	84.20
Object Affordance (Kopulla et al.)	84.70
MSLF (Koperski et al.)	85.48
R-HCRF (Liu et al.)	89.80
RSVM + LCNN (Lin et al.)	90.10
<b>Proposed Method</b>	<b>94.40</b>

Methods on NTU RGB+D	Accuracy [%]
Geometric Features (Zhang et al.)	70.26
VA-LSTM (Zhang et al.)	79.40
CMN (Zolfaghari et al.)	80.80
STA-hands (Baradel et al.)	82.50
Glimpse Clouds (Baradel et al.)	86.60
<b>Proposed Method</b>	<b>87.09</b>
<b>Proposed Method (with 2D+time CNN)</b>	<b>92.20</b>

# Conclusion

## Method:

- Effective and efficient Action Recognition of ADL
- Hyper parameter  $\alpha$  learned during training, handcrafted parameter  $\epsilon$  for similar action discrimination

## Experiments:

- Satisfactory results ranging from 87% to 98% on 4 public datasets improving the state of the art.

## Perspectives:

- ➡ Handcrafted parameter  $\epsilon$  for similar action pairs selection could be learned in a training phase from the confusion matrix.
- ➡ Action detection needed for long videos analysis in the wild

Any Question?

**Monique Thonnat, DR INRIA**  
***STARS, Sophia Antipolis France***

# An approach with serious exergames for assessment and stimulation of patients with neurocognitive disorders

G. Sacco *CHU Nice*, [M. Thonnat](#) *Inria*,  
G. Ben Sadoun *Cobtek*, P. Robert *CHU Nice*

# Introduction

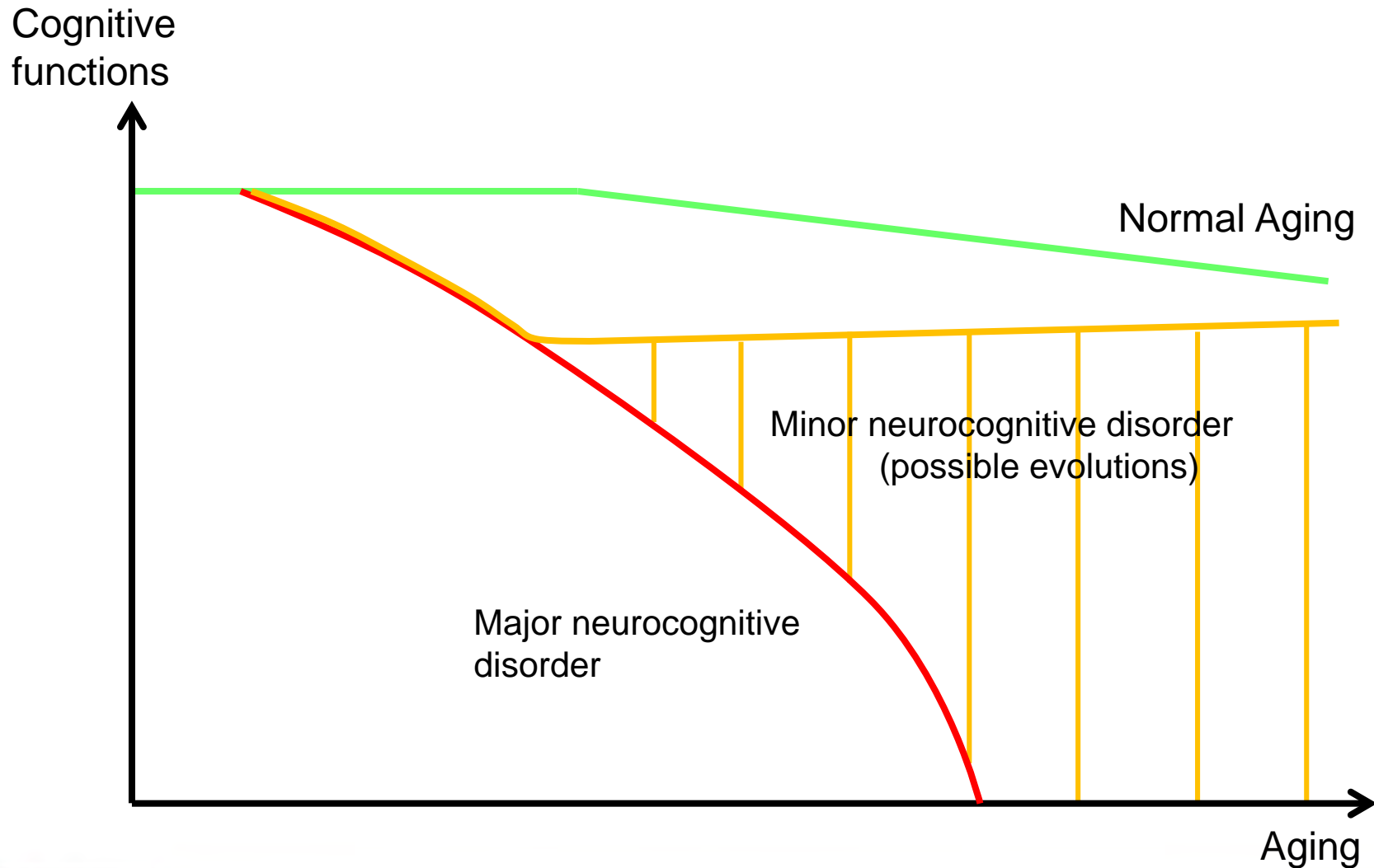
Context: Neurocognitive disorders care

Challenge:

- Digital techniques
- Non pharmacological approach for care
- Preserve Autonomy, Health and Well being:  
→ *focus on maintaining the cognitive functions*



# Introduction



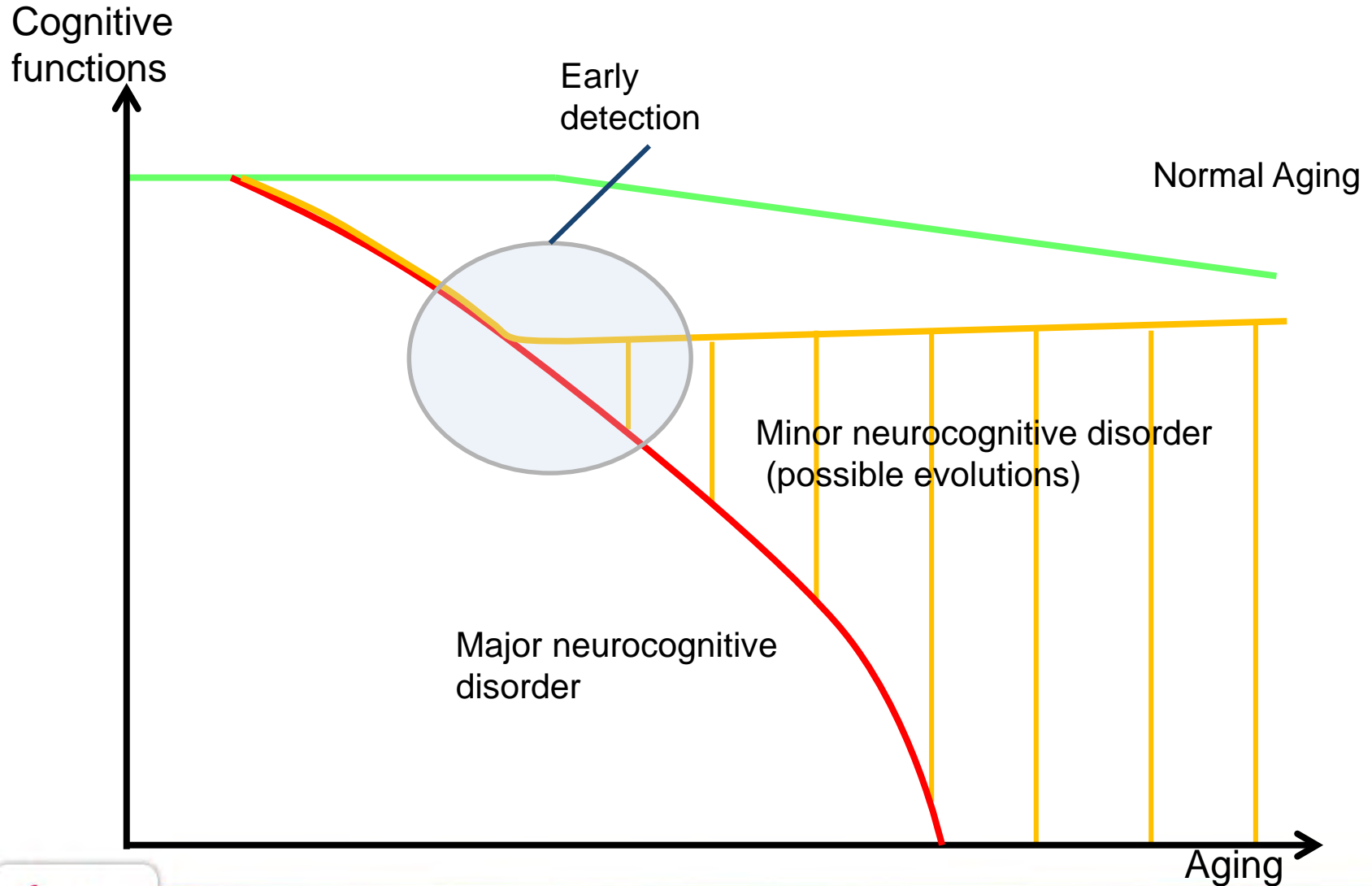
# Approach

Objective: *Early detection* of cognitive decline for effective care and preserving cognitive functions

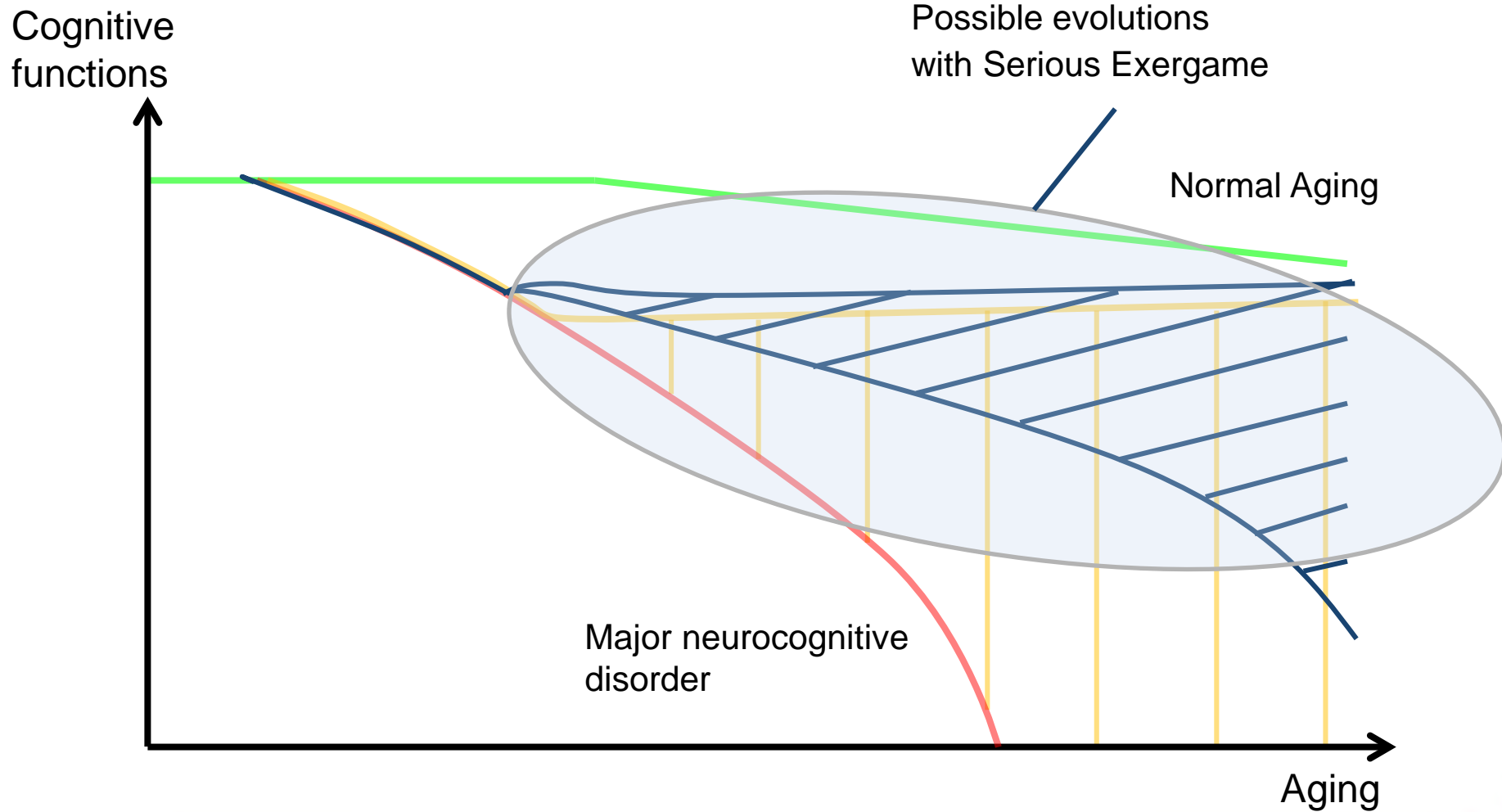
Method:

- Assessment:
  - Digital version of standard neuropsychological tests
  - Integrated in a serious game for patient comfort
- Stimulation:
  - Mixing cognitive and physical stimulation for better impact
  - Use of *Serious exergame* (= serious game with physical exercise)

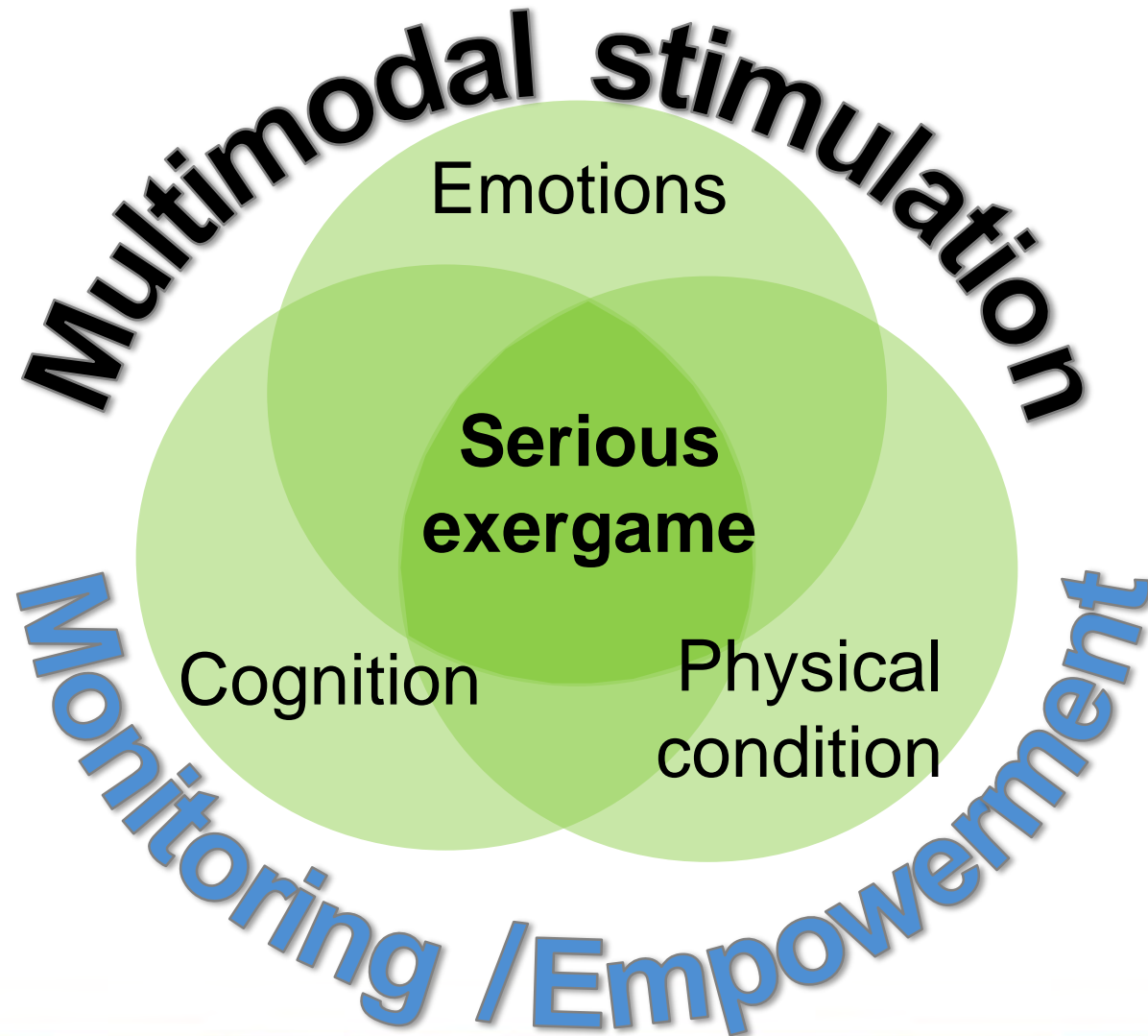
# Approach



# Approach



# Approach: serious exergame XTorp





# Approach: serious exergame XTorp

Physical and cognitive stimulation using an exergame with an RGB-D sensor



# Experiment 1

## Experiment 1:

Comparison of standard and digital versions of the Trail Making Test

## Material and methods:

- Population:
  - 3 kinds of population: 27 Healthy (*mean 72 years*), 27 MCI\* (*mean 77 years*), 21 Alzheimer (*mean 79 years*)
- Process:
  - each person is assessed by the digital and the standard versions
  - 2 groups: g1= standard then digital g2 = digital then standard
  - 2 subparts A (*digit numbers*) then B (*digit number + letters*)

\* MCI = Mild Cognitive Impairment ± minor neurocognitive disorders

# Experiment 1

Training then timed Trail Making Test

TMTA training

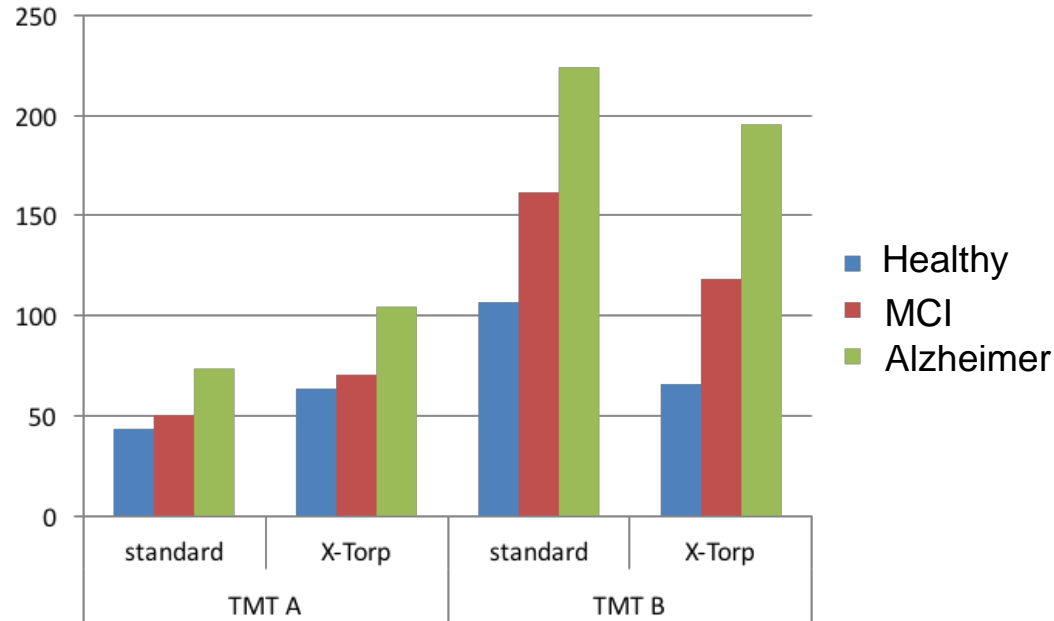
Reliez les mines entre elles et dans le bon ordre pour les désamorcer.

Vous devez commencer par le départ (1) et finir par l'arrivée(6).

Trail making Task

# Results on experiment 1

## Experiment 1: Comparison of standard and digital versions of the Trail Making Test



Time spent to complete the standard and the X-Torp versions of the TMT A and B

### Results:



- Both versions are able to discriminate Healthy from MCI and from Alzheimer disease patients

# Experiment 2

## Experiment 2:

Use of XTorp as serious exergame for stimulation of patients with neurocognitive disorders (NCD)

## Material and methods:

- Population:
  - 2 kinds of population: 8 Healthy (*mean 71 years*), 10 NCD (*mean 82 years*)
- Process:
  - 4 weeks of successive cognitive and physical stimulations
  - Physical stimulation by movement of legs and arms for both motion and interaction in the virtual environment. **Aerobic intensity target level**
  - Cognitive stimulation by digital versions of 5 tests: *Trail Making test, Digit Symbol Substitution test, IOWA gambling test, Delayed Matching to Sample 48 test and Cancellation test*



# Experiment 2



Physical then cognitive stimulation with the exergame



# Results on experiment 2

Experiment 2: Use of Xtorp as serious exergame for stimulation of patients with neurocognitive disorders (NCD)

## Results:

- All participants:
  - able to finish the game
  -  • same interest to play
  - low negative affects and perceived difficulty
- Neurocognitive disorders patients:
  -  • physically less active and less performant than Healthy
  - less positive affects and less skill feeling than Healthy

# Conclusion

## Assessment:

- Digital versions of assessment tests are feasible and performant enabling early detection (by discriminating MCI from Healthy)
- Integration of assessment test in a serious game convenient for the comfort of MCI and even Alzheimer patients.

## Stimulation:

- Mixing cognitive and physical stimulation has been done in a serious exergame XTorp
- Experiments have shown that XTorp is convenient for perceived usability and affects

## Limits:

- More experiments needed for evaluation of long term effects

# Perspectives

---

## Impact:

- Evaluation of cost and effectiveness for Alzheimer patients
  - on going study for 12 nursing homes

## Method:

- New way to use serious exergame without any therapist
  - important for long duration use by patient and early detection and stimulation

# Perspectives

---

## Impact:

- Evaluation of cost and effectiveness for Alzheimer patients
  - on going study for 12 nursing homes

## Method:

- New way to use serious exergame without any therapist
  - important for long duration use by patient and early detection and stimulation



Any Question?

**Monique Thonnat, DR INRIA**  
***STARS, Sophia Antipolis France***

Suivi de démences avec les outils  
TIC: expériences des projets ANR  
IMMED et EU IP Dem@care  
Jenny Benois-Pineau, UBX/LABRI

- 1. Introduction
- 2. Activités instrumentales—comme outil d'évaluation
- 3. ANR IMMED
- 4. FP7 IP Dem@care
- 5. Conclusion et perspectives

- Avec le vieillissement de la population en Europe, Amériques du Nord, un des problèmes consiste à développer des services et des technologies qui permettent de faciliter
  - › - l'aide aux personnes âgées à leur domicile
  - › - viennent en aide aux équipes médicales pour l'étude des phénomènes de vieillissement et des démences
- La propagation des démences liées à l'âge et notamment de la maladie d'Alzheimer est un phénomène épidémiologique
- Dans le monde plus de 35,6 mln de personnes sont touchées par la maladie d'Alzheimer [1]. Chaque année on dénombre 7,7 millions de cas.
- Selon l'OMS le nombre des malades devrait presque doubler tous les 20 ans. 65,7 millions en 2030 et 115,4 millions en 2050

[1] Définition et chiffres de la maladie d'Alzheimer, Fondation Recherche Alzheimer, <https://alzheimer-recherche.org/la-maladie-alzheimer/quest-maladie-dalzheimer/definition-et-chiffres/>, consulté le 18.11.2018

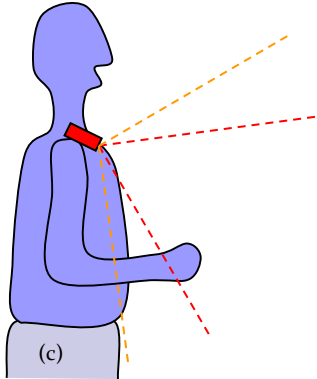
- Les difficultés fonctionnelles dans l'accomplissement des activités instrumentales de la vie quotidienne constituent des critères importants de diagnostic, qui peuvent apparaître jusqu'à 10 ans avant l'établissement d'un diagnostic clinique de la maladie mis en évidence par l'étude PAQUID[2].
- L'évaluation de la progression de la maladie chez des patients diagnostiqués s'appuie également sur l'évaluation des difficultés en activités instrumentales.
- Evaluation classique par des questionnaires: erreurs de deux types :
- aidants : exagération des difficultés des proches
- patients : diminution de leurs difficultés

[2]. Peres K, Helmer C, Amieva H, Orgogozo JM, Rouch I, Dartigues JF, Barberger-Gateau P. Natural history of decline in instrumental activities of daily living performance over the 10 years preceding the clinical diagnosis of dementia: a prospective populationbased study. J Am Geriatr Soc





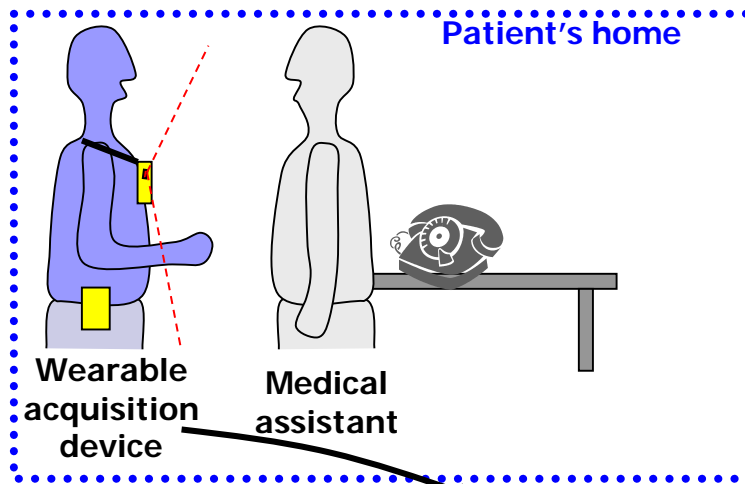
- Objectifs: développer et valider une technologie très novatrice reposant
- sur la caméra portée, permettant la mise en place de méthodologies nouvelles dans le domaine du diagnostic et du suivi des démences et ceci dans la situation ECOLOGIQUE (au domicile des patients)
- le développement d'un dispositif d'acquisition audio et vidéo embarquée ergonomique adaptée à l'application médicale visée,
- - la levée de verrous technologiques concernant l'analyse automatique des vidéos permettant
- une indexation nécessaire pour la consultation des données par un médecin expert,
- - la validation de ces technologies par leur intégration dans le cadre des études cliniques
- Partenaires : ISPED, équipe de vieillissement cérébral de J.-F. Dartigues, IRIT J. Pinquier, équipe SAMOVA, J. Pinquier, IMS- groupe Image, R. Megret, LABRI, équipe IS, groupe AIV, J. Benois-Pineau



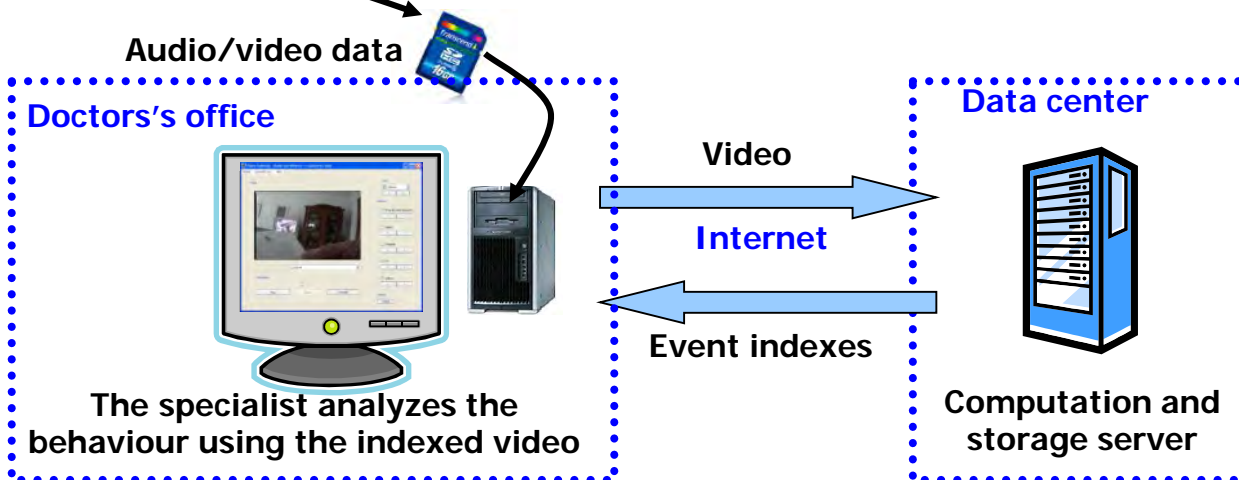
- Caméra sur l'épaule
- Poids et encombrement réduits
- Capture des activités instrumentales
- Positionnement étudié par ergothérapeutes



# Architecture générale du système

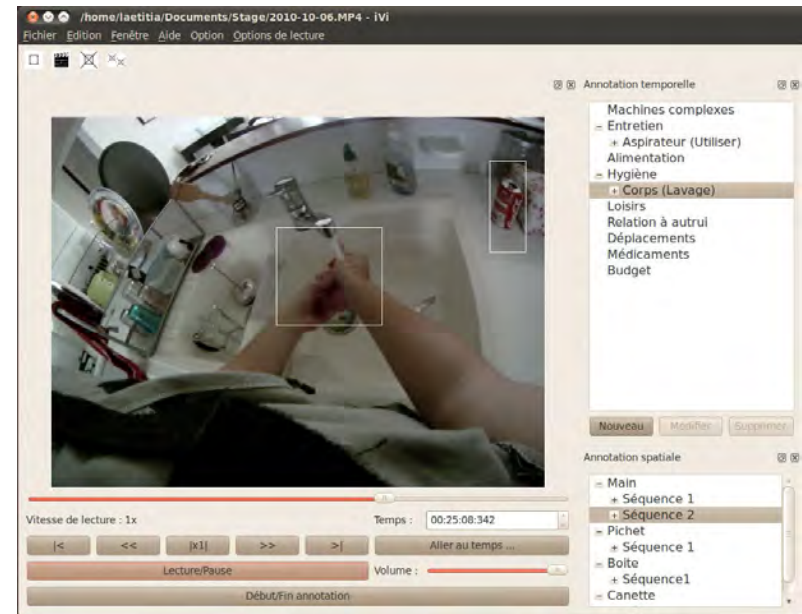


- Dispositif amené par l'assistant médical lors des visites des patients
- Observation sur quelques heures
- Récupération et analyse automatique de données
- Consultation des vidéos indexées via l'interface du médecin





Aperçu : vidéo embarquée



Interface de Navigation  
pour le Médecin



Dénomination globale	Action globale	Action de base
Machines complexes	Four	Allumer / Cuisson / Eteindre
	Télévision	Allumer/Télécommande/ Eteindre
	Cafetière	Utiliser
	Gazinière	Allumer / Cuisson / Eteindre
	Toaster	Utiliser
	Lave-vaisselle	Produits/Programme/ Remplir / Vider
	Machine à laver	Produits/Programme/ Remplir / Vider
Entretien	Micro-onde	Utiliser
	Débarrasser	
	Vaisselle à la main	Lavage/Essuyage / Rangement
	Lessive	Lavage à la main / Etendre / Repassage / Rangement
	Balais	Utiliser / Ranger
	Pelle	Utiliser
	Lit	Ranger
	Aspirateur	Utiliser
	Poubelle	Utiliser / Vider
	Alimentation	Boire
Manger		
Préparation manuelle		Découper/Servir/Remplir/Mettre le couvert
Hygiène	Vêtements	Enfilage/ Fermeture
	Corps	Lavage/Essuyage/Entretien
	Esthétique	Se parfumer/Se coiffer
Loisirs	Jardinage	Arroser/Planter, couper, récolter
	Animal	Caresses/Jeux
	Lecture	
	Regarder	
	Tricoter	
	Utiliser ordinateur	
Relation à autrui	Répondre au téléphone	
	Téléphoner	
	Visite maison	
Déplacements	Libre	Monter escaliers/Descendre escaliers/Passer porte/Marche
	Avec instruments	Se lever du lit/du fauteuil/ Marche aidée/Utiliser clés
Médicaments	Médicaments	Remplir pilulier/Utiliser pilulier
Budget	Budget	Règlement/Contrôle monnaie

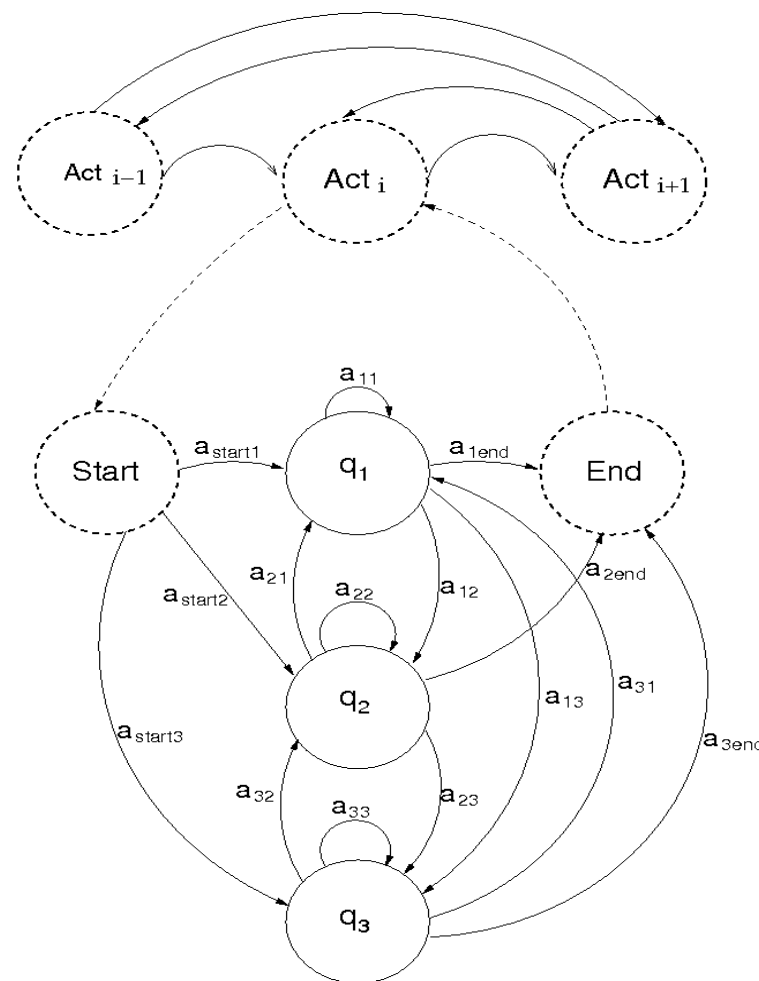
9 catégories d'activités  
35 activités au total

Corpus écologique vidéo :

Type	Nbr	Durée
Patients	42	17h04min
Volontaires sains	12	7h16min
<b>Total</b>	<b>54</b>	<b>24h20</b>

- Espaces de description visuel et audio par des descripteurs primaires
- Modèle HMM

- Deux niveaux:
  - Niveau supérieur:  
transitions entre activités
  - Niveau inférieur:  
modélisation d'une activité avec un nombre d'états variables (1, 3, 5, 9)



## → Résultats

- - l'acceptabilité du dispositif et du protocole d'enregistrement ont été effectués sur un échantillon de 7 sujets témoins

	N'entraînant pas de difficulté	Difficulté passagère ou de moyenne ampleur	Entraînant une forte difficulté
<u>Enfilage du dispositif</u>	100%	0%	0%
<u>Tenue lors des mouvements</u>	100%	0%	0%
<u>Entrave aux mouvements</u>	100%	0%	0%
<u>Poids</u>	100%	0%	0%
<u>Présence dans le champ visuel</u>	100%	0%	0%
<u>Présence à la conscience</u>	100%	0%	0%

- Meilleure accuracy de reconnaissance d'activités : 0,52
- Rappel : 0.370
- Précision : 0.293
- Conclusions : nécessité d'usage d'autres modalités: vidéo ambiante, capteurs physiologiques
- Nécessité de validation de protocole sur une grande cohorte

- Projet soutenu par l'Union Européenne 2011 - 2015
- 12 partenaires
- Expérimentation sur 4 sites : France, Suède, Irlande, Grèce
- Scenarios: CM, domicile, maison de retraite

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This project is funded by the European Union

AgeingWey  
Health  
Better Healthcare for Europe





## → Capteurs portés:

- › Physiologiques: WIMU, DTI – 2
- › Capteurs visuels de longue durée: SenseCam
- › Capteurs audiovisuels:
  - Microphone porté,
  - camera GoPro



## → Capteurs ambiants :

- › Gear 4 Sleep Clock
- › Static camCaméra statiqueera: Sony Kinect, ASUS RGB-D



## → Monitoring physiologique:

- › Objective, comprehensive picture of health objective et comprehensible de la santé: qualité du sommeil, anxiété etc
- › Comorbidités souvent présentes avec démence
- › Réponse rapide dans le cas d'urgence (ex. chute)
- › Increased sense of safety and security for PwD and carers

## → Life – logging:

- › Il donne une image compréhensible de la journée d'une personne
- › Utile pour constituer les journaux visuels des patients



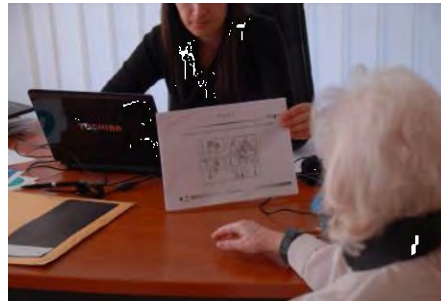
- Enregistrements audio à l'Association Grèque des Malades Alzheimer(GAADRD)
- CHU Nice



- Reconnaissance vocale de la maladie d'Alzheimer avec des tests
- “Pataka-pataka-pataka”

## → Audio testing at GAADR

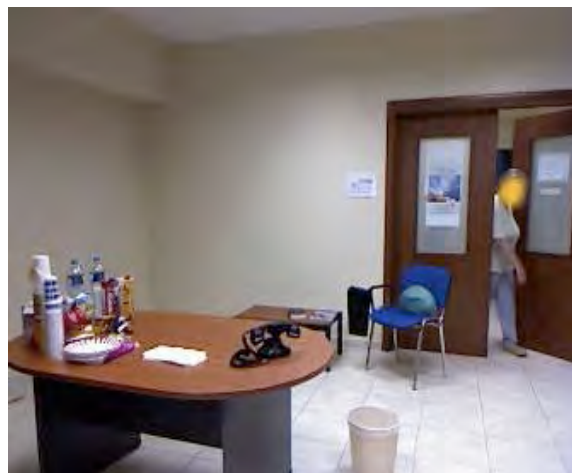
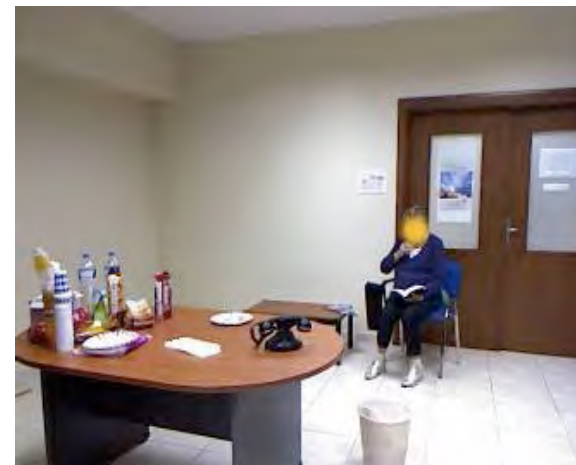
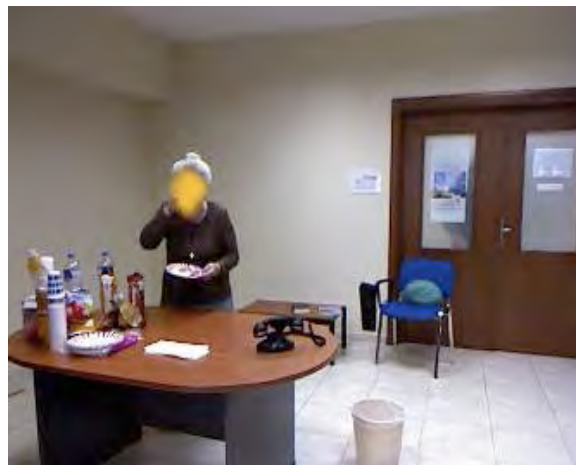
- › 90 volontaires agés de 65 et plus
- › En bon santé, troubles légères de mémoire, AD en phase initiale
- › Hommes et femmes



## → Tests “Pataka” : mémoire, condition vocale ,agilité

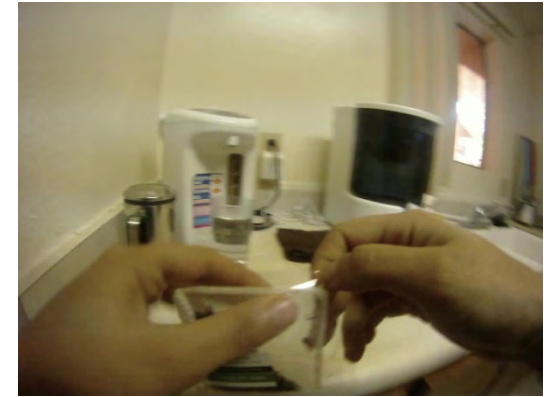
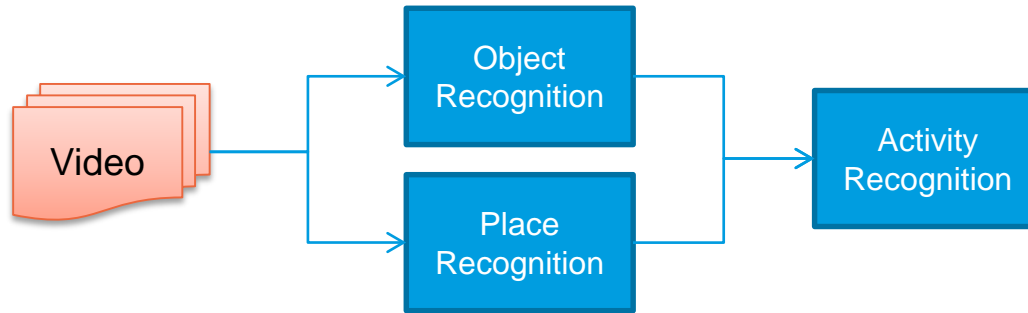
- › 83.3% de détection correcte de l'état des sujets

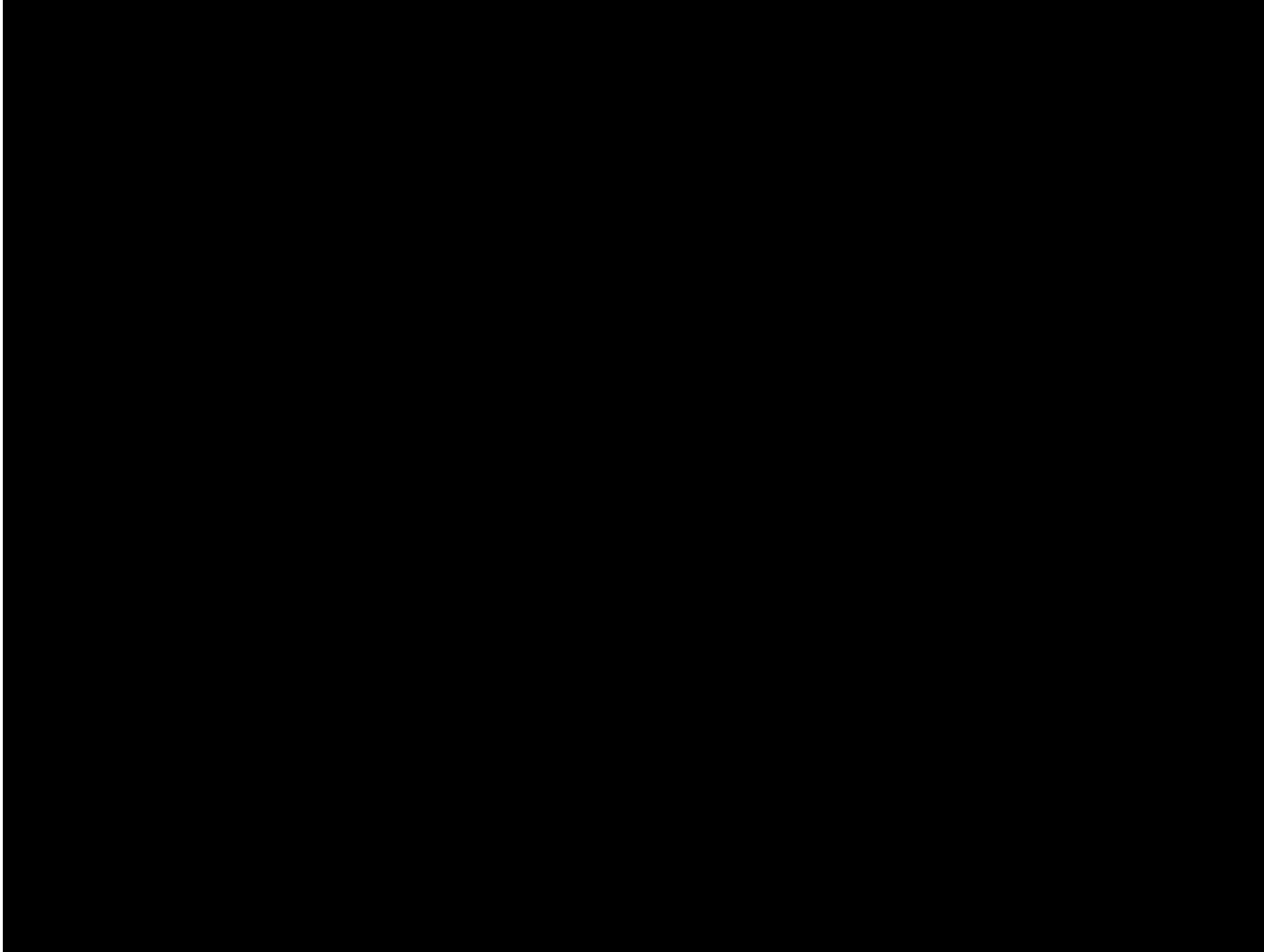
# Données enregistrées des activités instrumentales





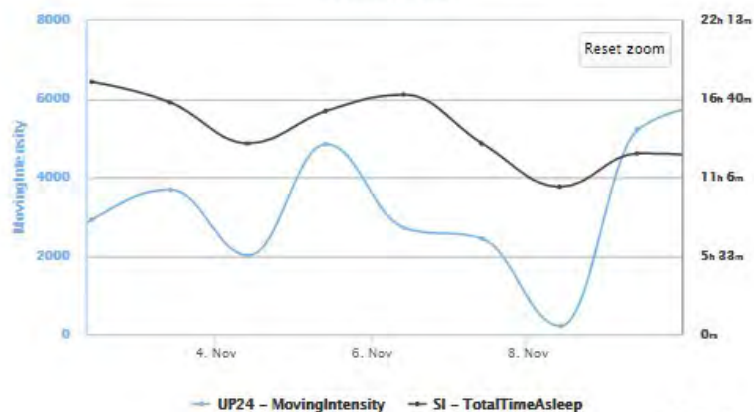
→ Activité: Sequence d'objets actifs(AOs) + Contexte (Lieu)



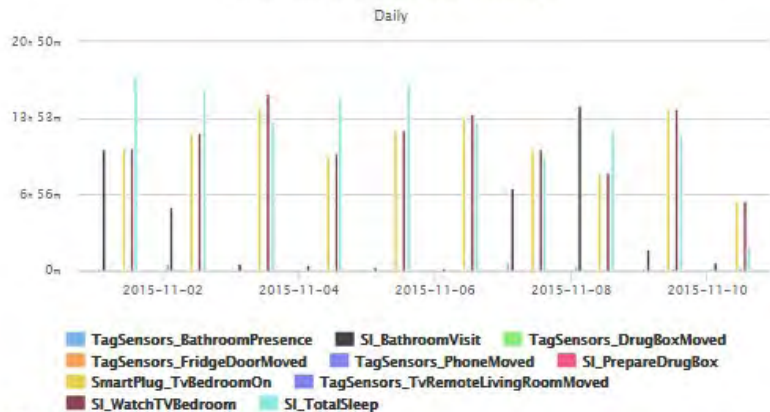




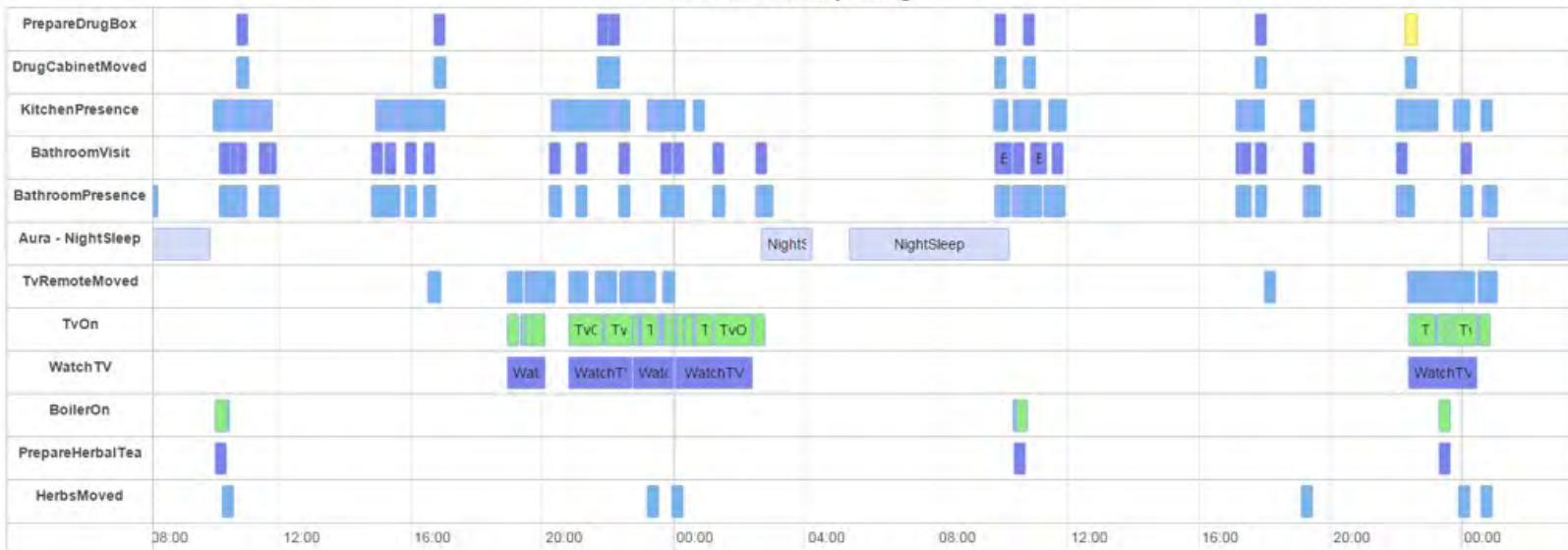
Measurements



Total duration for each activity



Activities of Daily Living



- Utilisation d'accéléromètre permet d'augmenter les taux de reconnaissance d'activités

	without dti	with dti	gains/losses
Use Phone	84.51	85.16	0.65
Leaving room	28.61	37.61	11.00
Looking at bus map	44.26	52.95	8.69
paying bill	83.21	82.79	-0.42
preparing drugs	89.41	89.73	0.32
preparing tea	83.42	81.06	-2.36
reading instructions	65.14	65.42	0.28
reading newspaper	39.89	40.07	0.18
watching tv	58.13	57.32	-0.81
watering plant	41.67	44.44	2.77
other activity	19.60	21.01	1.41
Mean	57.80	59.78	1.97

- Les recherches avec les TIC-IA menées dans le cadre des projets montrent:
- - l'acceptabilité des dispositifs portés pour les patients et sujets âgés;
- - la miniaturisation des capteurs permet d'avancer vite vers des dispositifs de plus-en-plus légers
- - les taux de reconnaissance augmentent en permanence spécifiquement avec l'apparition de nouveaux classifieurs IA – réseaux profonds
- - les situations de plus en plus complexes peuvent être détectées.
- Nous pouvons aider avec des technologies IC et de l'IA à nos séniors

## Gracias por su atención!