# Ontario Critical Care Clinical Practice Rounds (OC3PR)

February 13, 2025

## ICU Staffing Patterns: Outcomes for Patients and for Learners

Chaired by Dr. Dave Neilipovitz

Presented by Dr. Hannah Wunsch & Dr. Dominique Piquette

**Meeting Etiquette**

- Attendees can submit questions to Q&A in the Zoom icon in the menu
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Weill Cornell Medicine
Anesthesiology

# Is 'continuity of care' always good for ICU patients?


**Hannah Wunsch, MD MSc**

**Professor and Vice Chair for Research**

**Department of Anesthesiology**

**Weill Cornell Medicine**


AICORN
Acute & Intensive Care Outcomes Research Network

75 YEARS OF EXCELLENCE

# Disclosures

Book (***The Autumn Ghost***), Greystone Books

<u>Research Funding</u>

NIH (US)

CIHR (Canada)

Department of Defense (US)

AFP (Canada)

Continuity of care is a patient-centered outcome

What enabled delivery of continuity of care?

Why is continuity of care so much harder to deliver now?

Are there any benefits to a decrease in continuity of care?

# 1958

Barrie Fairley



Max Harry Weil



Peter Safar

# The ultimate continuity…

**Working/On call 24/7**

**365 days a year**

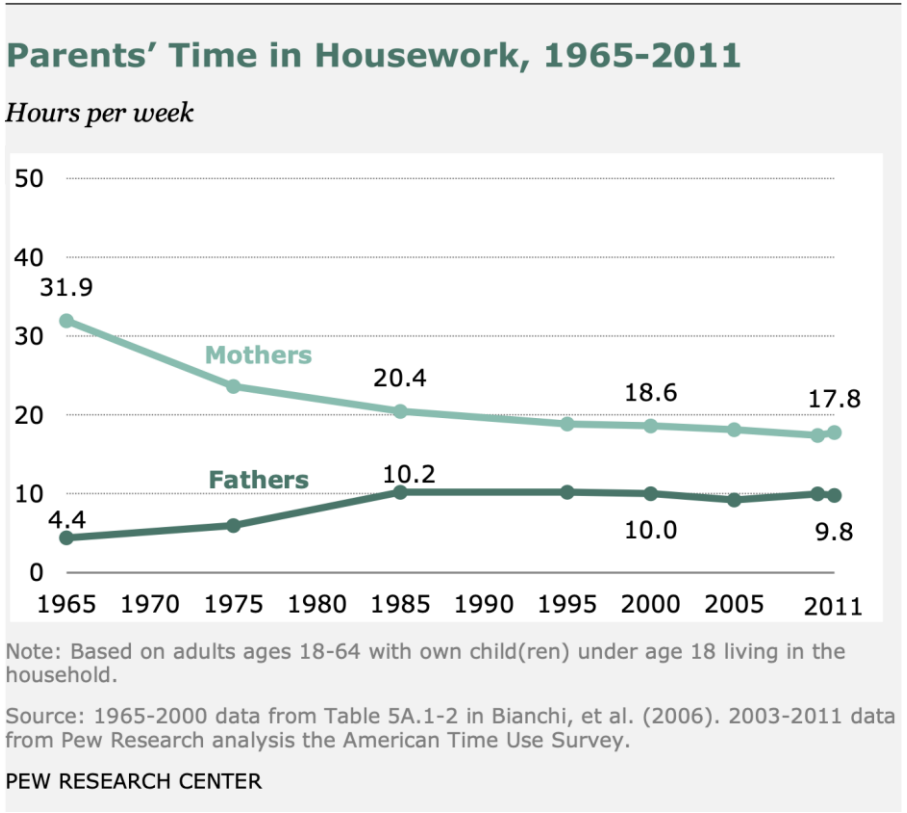
# Let’s dissect

**On call/working 24/7 for 1 month straight**

# What enabled delivery of continuity of care?

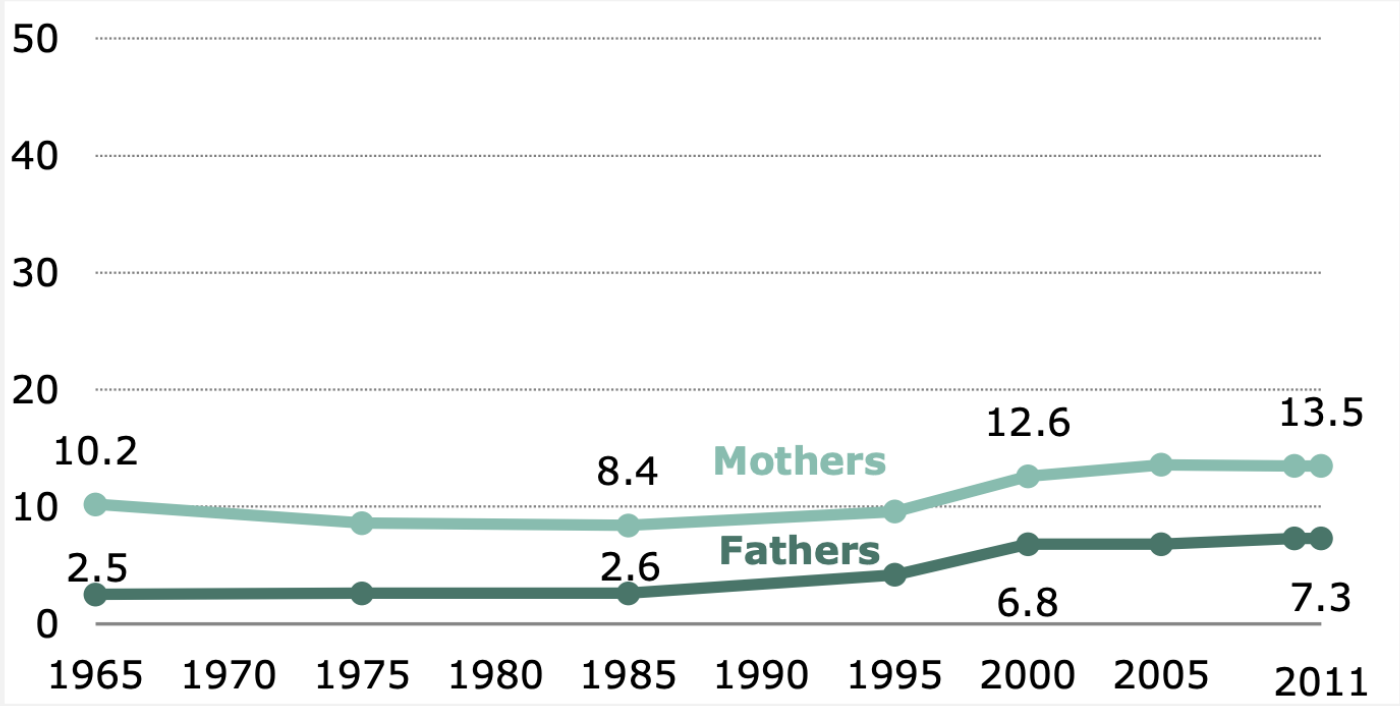
## 1950s

- Percentage of doctors who were women: 6%
- Marriage rate for men: 90%
- Percentage of married women who worked outside the home: 20%



# Parents' Child Care Time, 1965-2011

*Hours per week*




Note: Based on adults ages 18-64 with own child(ren) under age 18 living in the household.

Source: 1965-2000 data from Table 5A.1-2 in Bianchi, et al. (2006). 2003-2011 data from Pew Research analysis the American Time Use Survey.

PEW RESEARCH CENTER

# Nørre Alle – nursing residence, Copenhagen

- A ‘calling’

- Unmarried
- Often lived ‘on-site’
- 8 hr shifts (often longer)

# *“Back in the days of the giants…”*

- How many patients?
  - ICUs were small(er), so generally not so many
- What could be done for patients?
  - Not a lot
- How much help?
  - Academic centers: a lot
- Who does nights and weekends?
  - Junior trainees (staff never called even though ‘on call’)
- Expectations of patients and families
  - Minimal

# Why is continuity of care so much harder to deliver now?

- ICUs are bigger
- Workforce is more diverse
- Administrative and other support has ⬇
- Patient complexity ⬆
- Speed of delivery of care has ⬆
- Length of hospital stay ⬇
- Family expectations have ⬆

[ Critical Care Original Research ]

CHEST

# ICU Staffing in the United States



*Hayley B. Gershengorn, MD; Allan Garland, MD; Deena K. Costa, PhD, RN; Amy L. Dzierba, PharmD; Robert Fowler, MDCM; Andrew A. Kramer, PhD; Vincent X. Liu, MD; Danny Lizano, MSHS, PA-C; Damon C. Scales, MD, PhD; and Hannah Wunsch, MD*

# 596 US ICUs

**TABLE 2** ] Staffing Characteristics Stratified by ICU Type

| Characteristic | Mixed ICU[a] | Medical ICU[b] | Surgical ICU[c] | Specialty ICU[d] |
|---|---|---|---|---|
| Consecutive days by intensivist | | | | |
| > 14 d | 10 (2.6) | 0 (0.0) | 1 (1.5) | 2 (3.7) |
| 14 d | 34 (8.9) | 6 (11.3) | 2 (3.0) | 2 (3.7) |
| 7 d | 238 (62.6) | 36 (67.9) | 55 (82.1) | 39 (72.2) |
| 5 d | 54 (14.2) | 7 (13.2) | 5 (7.5) | 9 (16.7) |
| Other/variable | 25 (6.6) | 2 (3.8) | 2 (3.0) | 1 (1.9) |
| Unknown | 19 (5.0) | 2 (3.8) | 2 (3.0) | 1 (1.9) |

Gershengorn et al, *Chest* 2024


# Association Between Consecutive Days Worked by Intensivists and Outcomes for Critically Ill Patients

Hayley B. Gershengorn, MD, FCCM, ATSF[1,2]; David V. Pilcher, MBBS, MRCP, FRACP, FCICM[3,4,5]; Edward Litton, MBChB, FCICM, MSc, PhD[6,7]; Matthew Anstey, MBBS, FCICM, FACEM, MPH[8,9]; Allan Garland, MD, MA[10,11,12]; Hannah Wunsch, MD, MSc, FCCM[13,14]

CCM 2020

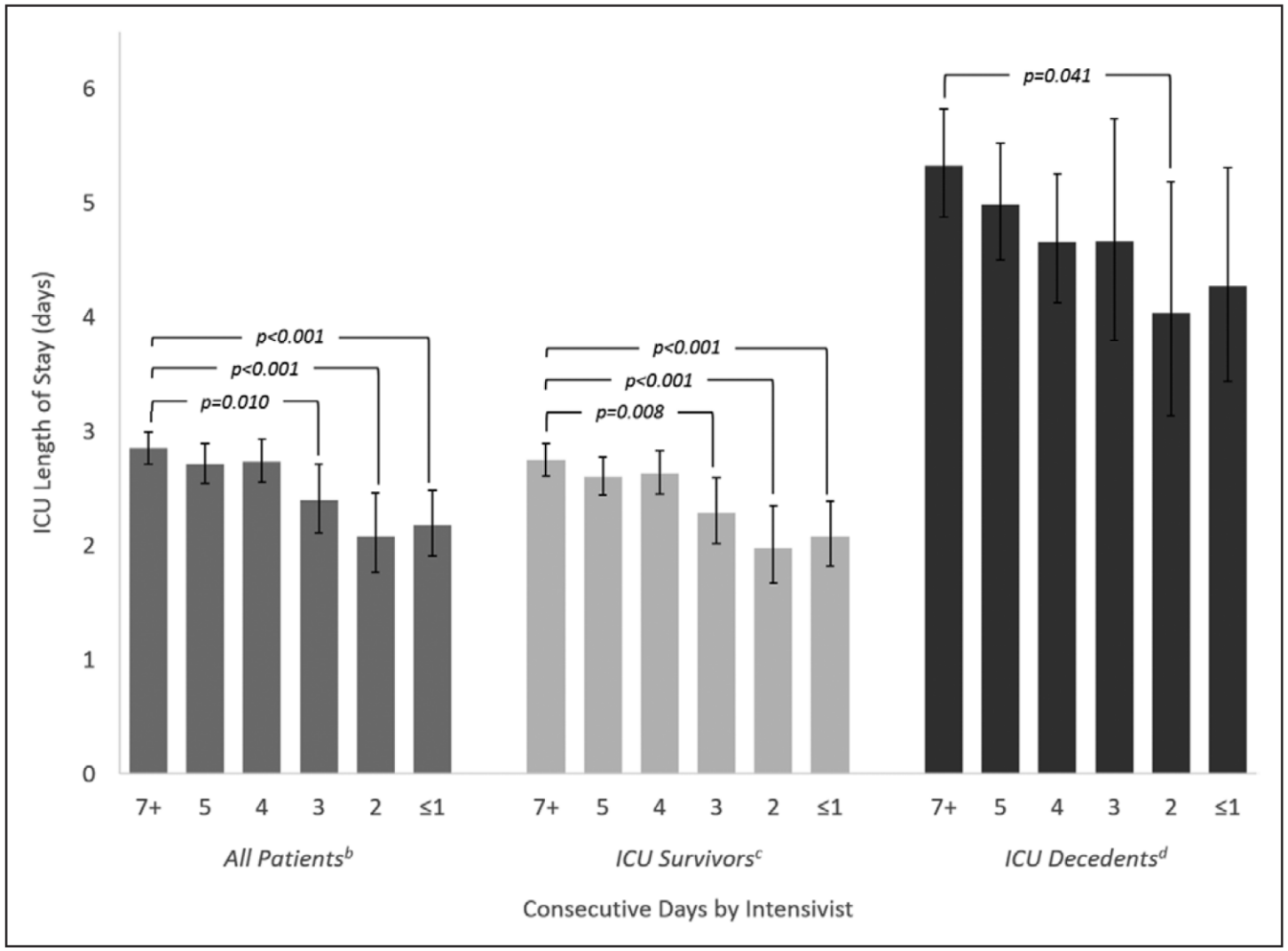



**Figure 1.** Association between consecutive days worked by the intensivist and severity-of-illness–adjusted ICU length of stay. [a]Assuming cohort average value for predicted mortality spline terms; error bars = 95% CIs. [b]$p < 0.001$ for overall association between consecutive days and ICU length of stay. [c]$n = 214{,}596$ (95.4%); $p < 0.001$ for overall association between consecutive days and ICU length of stay. [d]$n = 10{,}259$ (4.6%); $p = 0.15$ for overall association between consecutive days and ICU length of stay.

Gershengorn et al *CCM* 2020

ORIGINAL ARTICLE

# Nighttime Cross-Coverage Is Associated with Decreased Intensive Care Unit Mortality

## A Single-Center Study

Andre Carlos Kajdacsy-Balla Amaral[1,2], Bernardo S. Barros[1], Camilla C. P. P. Barros[1], Cameron Innes[1,3], Ruxandra Pinto[1], and Gordon D. Rubenfeld[1,2]

[1]Department of Critical Care Medicine, Sunnybrook Health Sciences Centre, Toronto, Canada; [2]Interdepartmental Division of Critical Care Medicine, University of Toronto, Toronto, Canada; and [3]School of Medicine, University of Aberdeen, Aberdeen, United Kingdom

**Table 4:** Primary and Sensitivity Analysis of the Effects of Nighttime Cross-Coverage on Mortality

| Statistical Analysis | Definition of Exposure | Population | Outcome Measured | Estimated Benefit of Additional Cross-Coverage (95% CI) | *P* Value |
|---|---|---|---|---|---|
| Logistic regression | Counts of cross-coverage on first 7 d | All | ICU mortality | OR, 0.77 (0.60–0.99) | 0.040 |
| Time-dependent Cox model | Counts of cross-coverage on first 7 d | All | Time to ICU death | HR, 0.78 (0.63–0.96) | 0.018 |
| Landmark analysis with logistic regression | Counts of cross-coverage on first 7 d | Alive at Day 7 | ICU mortality | OR, 0.86 (0.62–1.18) | 0.345 |
| Landmark analysis with Cox model | Counts of cross-coverage on first 7 d | Alive at Day 7 | Time to ICU death | HR, 0.74 (0.56–0.99) | 0.042 |
| Time-dependent Cox model | Percentage cross-coverage on first 7 d, per 10% | All | Time to ICU death | HR, 0.91 (0.84–0.99) | 0.048 |
| Unadjusted comparison of highest and lowest quartiles | Quartile of exposure to cross-coverage | Highest and lowest quartiles | ICU mortality | RR, 0.83 (0.56–1.24) | 0.240 |
| Time-dependent Cox model | Cross-coverage status until discharge (binary, noncumulative) | All | Time to ICU death | HR, 0.82 (0.54–1.27) | 0.387 |

*Definition of abbreviations*: CI = confidence interval; HR = hazard ratio; ICU = intensive care unit; OR = odds ratio; RR = relative risk.

**Table 5:** Comparisons between Cross-Covering and Continuity Nights

| | Fellow Cross-Covering | |
|---|---|---|
| | **Yes (*n* = *400*)** | **No (*n* = *125*)** |
| Age, yr, mean (SD) | 54.7 (22.5) | 56.6 (20.6) |
| APACHE II, median (IQR) | 24 (21 to 29) | 24 (21 to 28.5) |
| ICU length of stay, median (IQR) | 7 (3 to 19) | 7 (3 to 14) |
| SOFA score at day of assessment, mean (SD) | 6.5 (4.1) | 6.2 (4.1) |
| Nighttime decisions, n (%) | 77 (19.3) | 13 (10.4)* |
| Computed tomography scan | 20 (5) | 1 (0.8) |
| Antibiotics | 31 (7.8) | 6 (4.8) |
| Changes in mechanical ventilation | 17 (4.2) | 4 (3.2) |
| Changes in extubation planning | 13 (3.2) | 2 (1.6) |
| Sedation and analgesia | | |
| Sedatives (changes in mg/h of midazolam equivalents), mean (SD) | −0.3 (8.8) | −0.1 (11.2) |
| Opioids (changes in μg/h of fentanyl equivalents), mean (SD) | 3.3 (33.2) | −6.6 (34.7)* |
| Resuscitation | | |
| Fluid bolus (changes in ml), median (IQR) | +233 (−778 to +933) | −583 (−778 to +622) |
| Transfusion (changes in ml), median (IQR) | −78 (−415 to +266) | −544 (−724 to −417)* |

*Definition of abbreviations*: APACHE = Acute Physiology and Chronic Health Evaluation; ICU = intensive care unit; IQR = interquartile range; SOFA = Sequential Organ Failure Assessment.
*$P < 0.05$.

## Burnout, and Fulfillment, in the Profession of Critical Care Medicine

*To the Editor*:

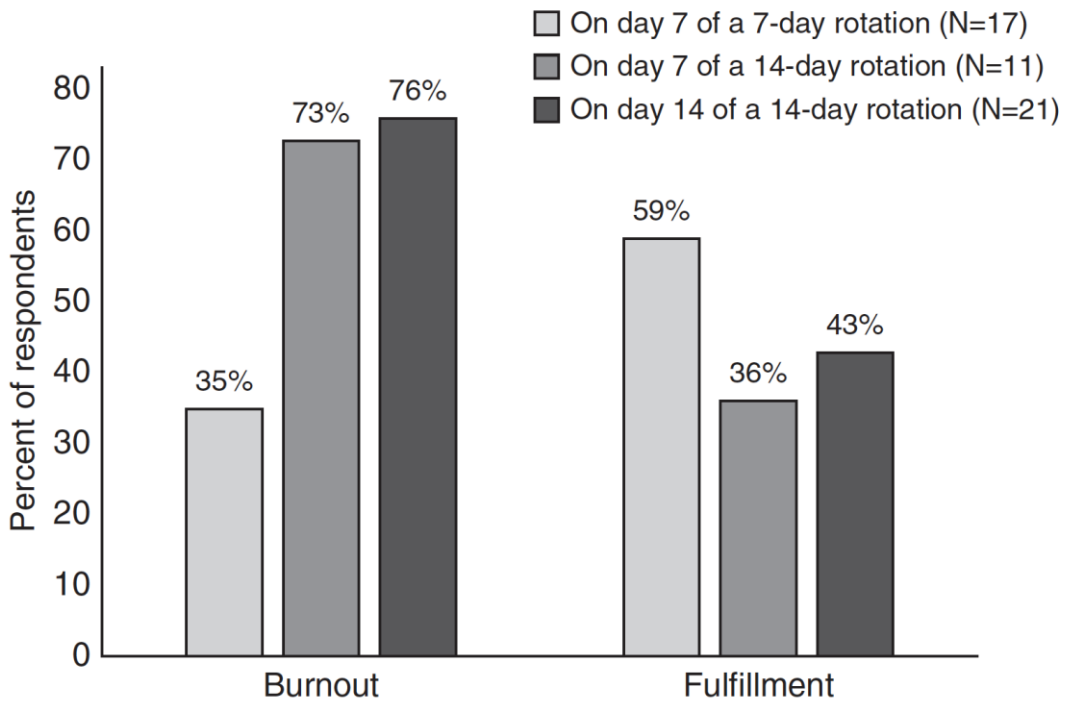



**Figure 1.** Burnout and fulfillment by rotation length in medical ICU A.

Kerlin et al *AJRCCM 2019*

Published in final edited form as:
*Health Aff (Millwood)*. 2012 November ; 31(11): 2501–2509. doi:10.1377/hlthaff.2011.1377.

# The Longer The Shifts For Hospital Nurses, The Higher The Levels Of Burnout And Patient Dissatisfaction

**Amy Witkoski Stimpfel**,
Research fellow at the Center for Health Outcomes and Policy Research at the University of Pennsylvania, School of Nursing, in Philadelphia

**Douglas M. Sloane**, and
Adjunct professor at the University of Pennsylvania, School of Nursing

**Linda H. Aiken**
Claire M. Fagin Leadership Professor of Nursing, a professor of sociology, and director of the Center for Health Outcomes and Policy Research at the University of Pennsylvania, School of Nursing

Amy Witkoski Stimpfel: amywit@nursing.upenn.edu

## Relationship Between Nurses' Shift Length And Outcomes For Patients

| | Adjusted coefficients for percent of nurses working in the shift length category | | | |
|---|---|---|---|---|
| **Patient outcome** | **>13 hours** | **12–13 hours** | **10–11 hours** | **8–9 hours** |
| Patients rated hospital ≤6 of 10[a] | 1.2** | 0.1 | −1.2 | −0.1 |
| Patients would not recommend the hospital[b] | 0.8** | 0.1** | −1.2** | −0.2** |
| **PATIENT OUTCOMES REPORTED AS "SOMETIMES" OR "NEVER"** | | | | |
| Nurses communicated well[c] | 1.0*** | 0.2*** | −1.4*** | −0.2*** |
| Staff explained medications[d] | 1.1** | 0.2** | −1.1 | −0.2** |
| Pain was controlled[e] | 0.9*** | 0.2 | −0.9** | −0.1 |
| Patients received help as soon as they wanted[f] | 2.1*** | 0.3** | −1.3 | −0.3*** |

Stimpfel et al, *Health Aff,* 2012

## Relationship Between Nurses' Shift Length And Outcomes For Nurses

| | Unadjusted | | Fully adjusted[a] | |
|---|---|---|---|---|
| **Shift length, hours** | **OR** | **95% CI** | **OR** | **95% CI** |
| **BURNOUT** | | | | |
| 10–11 | 1.71 | 1.48, 1.97 | 1.58 | 1.35, 1.84 |
| 12–13 | 1.13 | 1.04, 1.22 | 1.11 | 1.02, 1.20 |
| >13 | 2.85 | 2.47, 3.28 | 2.70 | 2.32, 3.15 |
| **JOB DISSATISFACTION** | | | | |
| 10–11 | 1.72 | 1.47, 2.02 | 1.67 | 1.40, 1.99 |
| 12–13 | 1.10 | 1.00, 1.20 | 1.12 | 1.03, 1.22 |
| >13 | 2.42 | 2.09, 2.81 | 2.38 | 2.04, 2.79 |
| **INTENTION TO LEAVE EMPLOYER WITHIN A YEAR** | | | | |
| 10–11 | 1.49 | 1.21, 1.85 | 1.55 | 1.24, 1.95 |
| 12–13 | 1.53 | 1.37, 1.71 | 1.45 | 1.30, 1.63 |
| >13 | 2.79 | 2.32, 3.35 | 2.57 | 2.10, 3.15 |

Stimpfel et al, *Health Aff*, 2012

**Table 3**. Participation in formal clinical intensive care unit (ICU) rounds by healthcare worker (HCW) type. Values are: N (% of those with those rounds) [% of all 574 ICUs]

| *Healthcare worker type* | *Weekday rounds* | *Weekend rounds* | *p-value** |
|---|---|---|---|
| INDIVIDUAL HCW TYPES | | | |
| Intensivist | 530 (96.7) [92.3] | 402 (93.7) [70.0] | 0.03 |
| Clinical pharmacist | 468 (85.4) [81.5] | 164 (38.2) [28.6] | 0.001 |
| Respiratory therapist | 396 (72.3) [69.0] | 241 (56.2) [42.0] | 0.001 |
| *All three of the above* | 333 (60.8) [58.0] | 123 (28.7) [21.4] | 0.001 |
| Dietitian | 340 (62.0) [59.2] | 85 (19.8) [14.8] | 0.001 |
| Social worker | 274 (50.0) [47.7] | 78 (18.2) [13.6] | 0.001 |
| Physical therapist | 198 (36.1) [34.5] | 55 (12.8) [9.6] | 0.001 |
| Occupational therapist | 132 (24.1) [23.0] | 32 (7.5) [5.6] | 0.001 |
| Pastoral care | 123 (22.4) [21.4] | 54 (12.6) [9.4] | 0.001 |
| Speech pathologist | 87 (15.9) [15.2] | 12 (2.8) [2.1] | 0.001 |
| COMPOSITES OF TYPES | | | |
| Nutrition practitioners[1] | 342 (62.4) [59.6] | 82 (19.1) [14.3] | 0.001 |
| Rehabilitation practitioners[2] | 199 (36.3) [34.7] | 55 (12.8) [9.6] | 0.001 |
| Social support practitioners[3] | 288 (52.6) [50.2] | 82 (19.1) [14.3] | 0.001 |
| *All three of the above* | 154 (28.1) [26.8] | 45 (10.5) [7.8] | 0.001 |

* Fisher's exact test, among those with rounds, adjusted for 14 comparisons via Sime's false discovery rate method; [1]dietitians and speech pathologists; [2]physical therapists and occupational therapists; [3]social workers and pastoral care

Garland et al, *Annals ATS*, in press

# LENGTH OF (PHYSICIAN) SERVICE

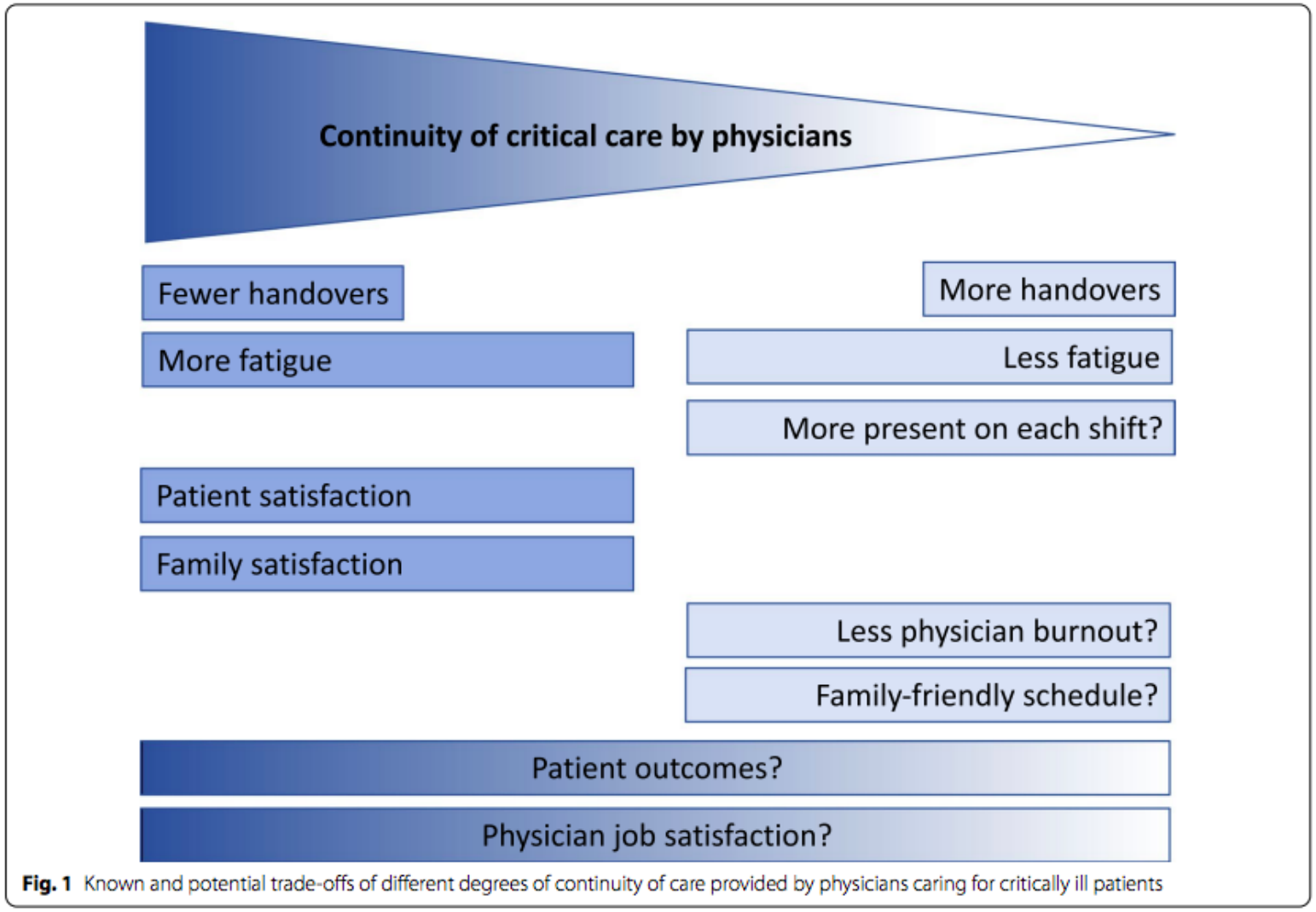



**Fig. 1** Known and potential trade-offs of different degrees of continuity of care provided by physicians caring for critically ill patients

Wunsch *Crit Care* 2020

Wunsch *Crit Care* (2020) 24:695
https://doi.org/10.1186/s13054-020-03426-z

Critical Care

EDITORIAL

Open Access

# Getting out of the 1950s: rethinking old priorities for staffing in critical care

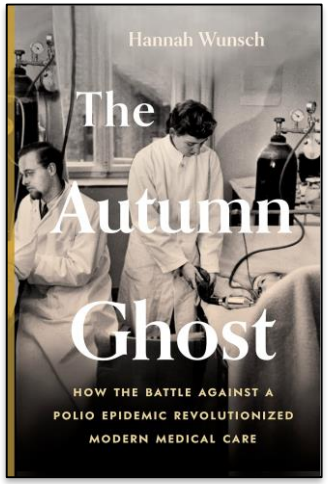
Hannah Wunsch[1,2,3,4*]

# Thank you!

**haw9006@med.cornell.edu**

AICORN
Acute & Intensive Care Outcomes Research Network

https://aicorn-research.com/



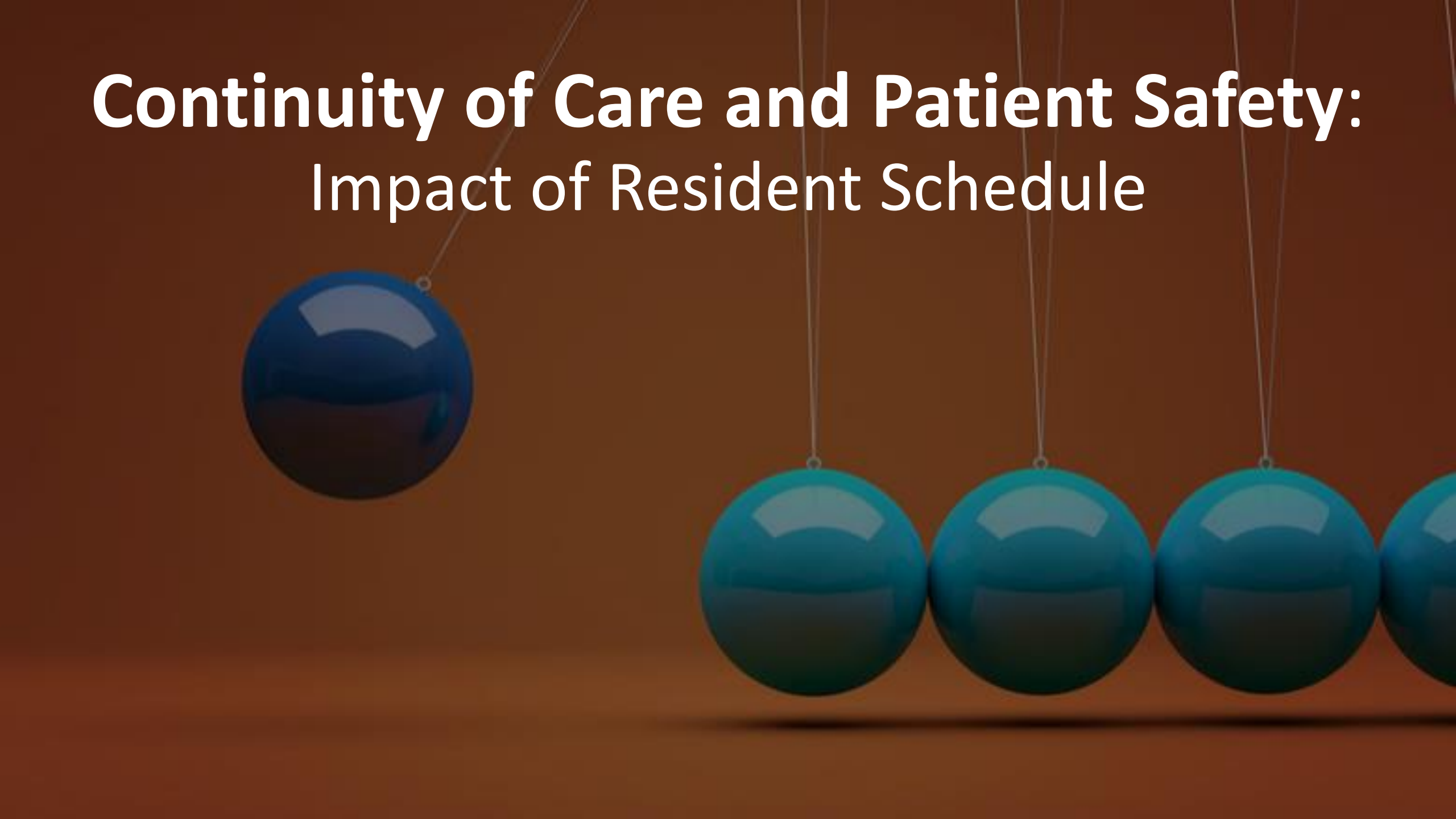

Weill Cornell Medicine
Anesthesiology

# No conflict of interest relevant to this talk.

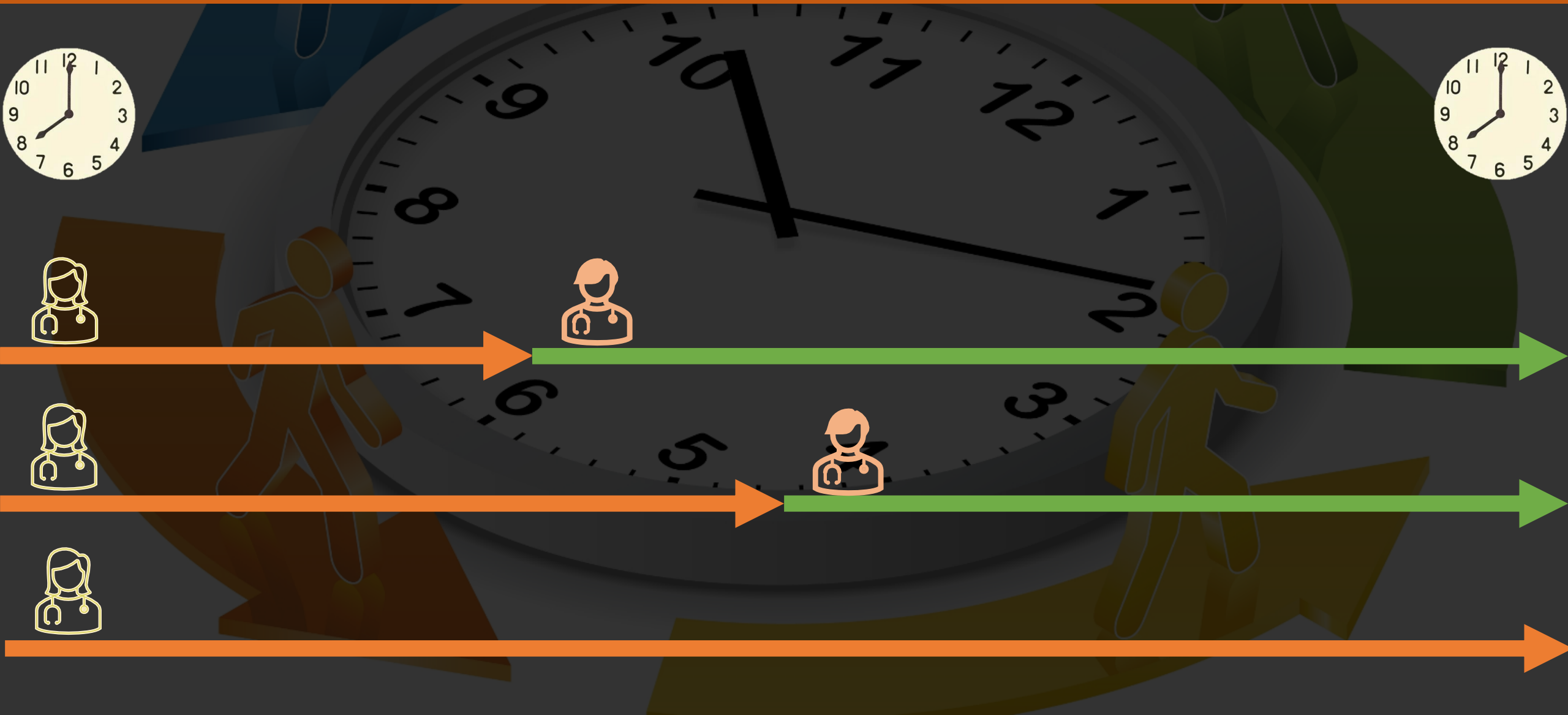
I have received grant funding from CIHR, RCPSC, The PSI Foundation, AFP Innovation Funds

I have done a lot of 24h calls.

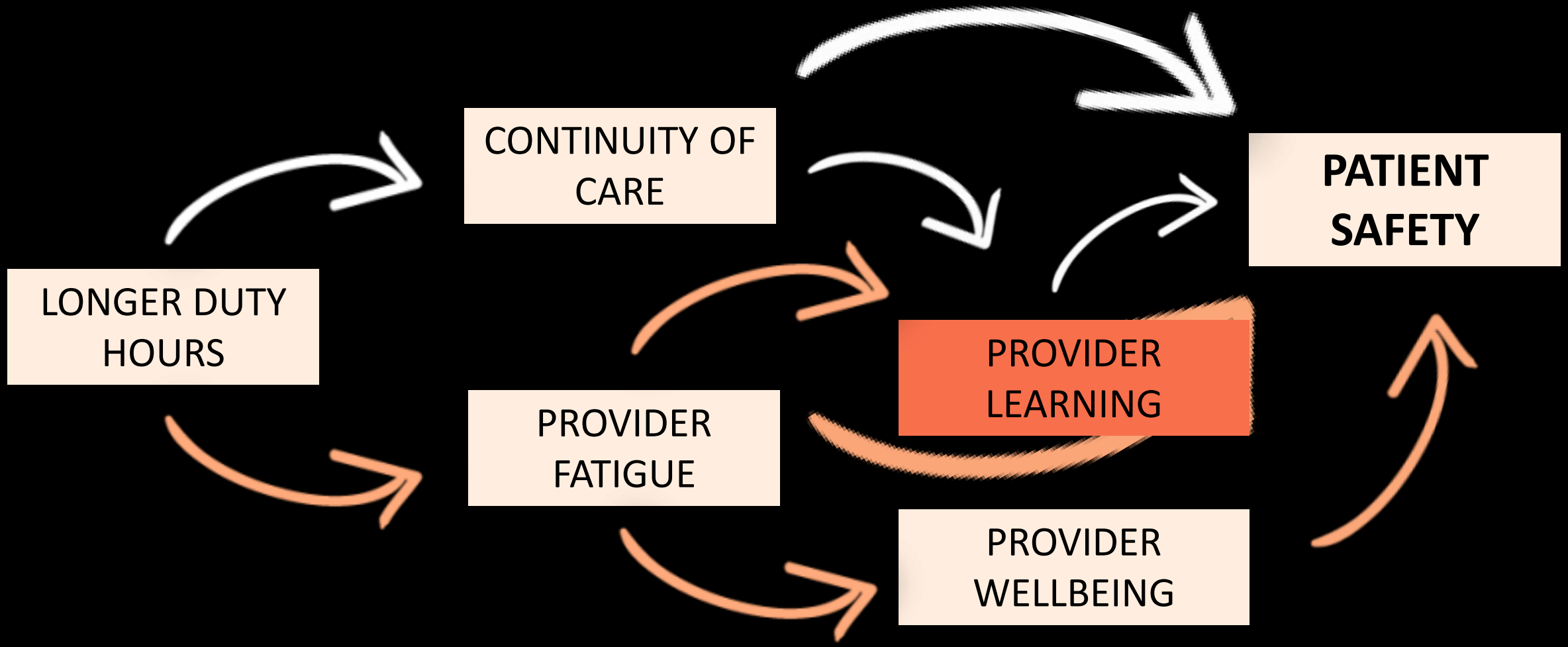
# **Continuity of Care and Patient Safety:**
## Impact of Resident Schedule



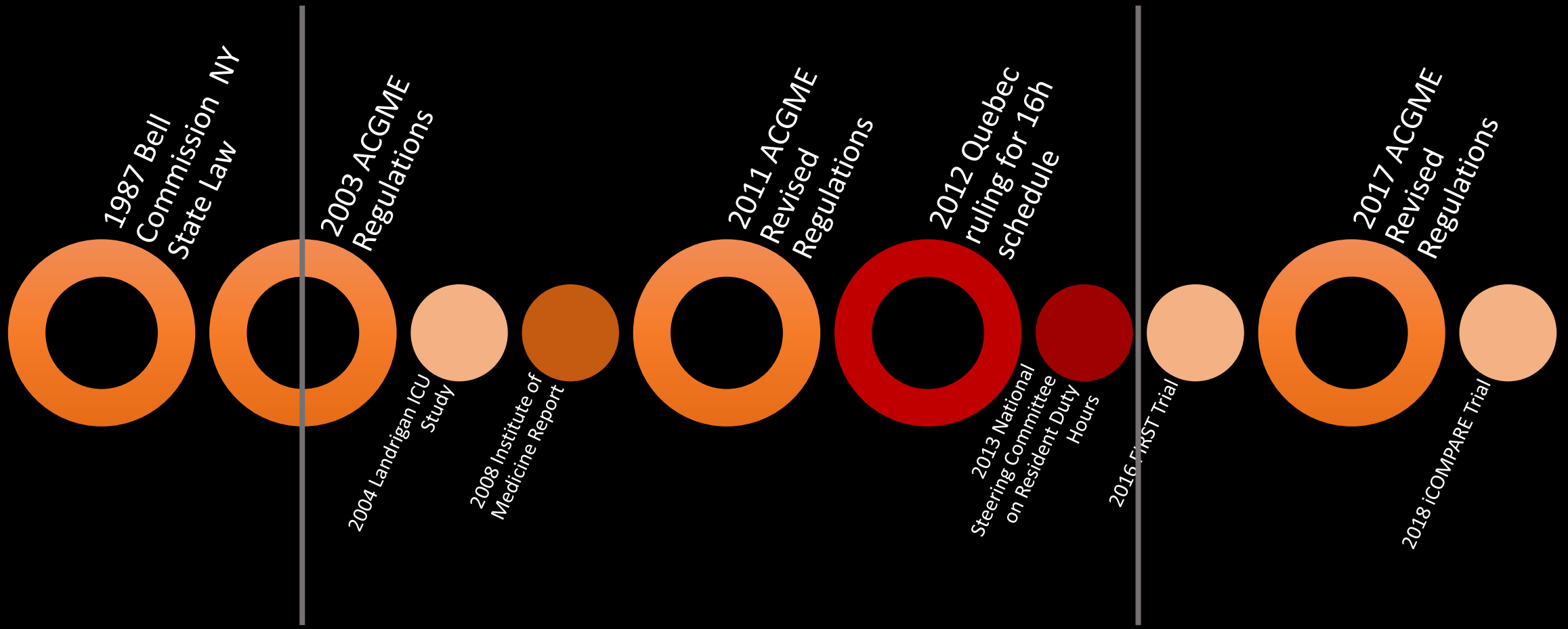
# MODELS TO PROVIDE 24H / 7 CARE



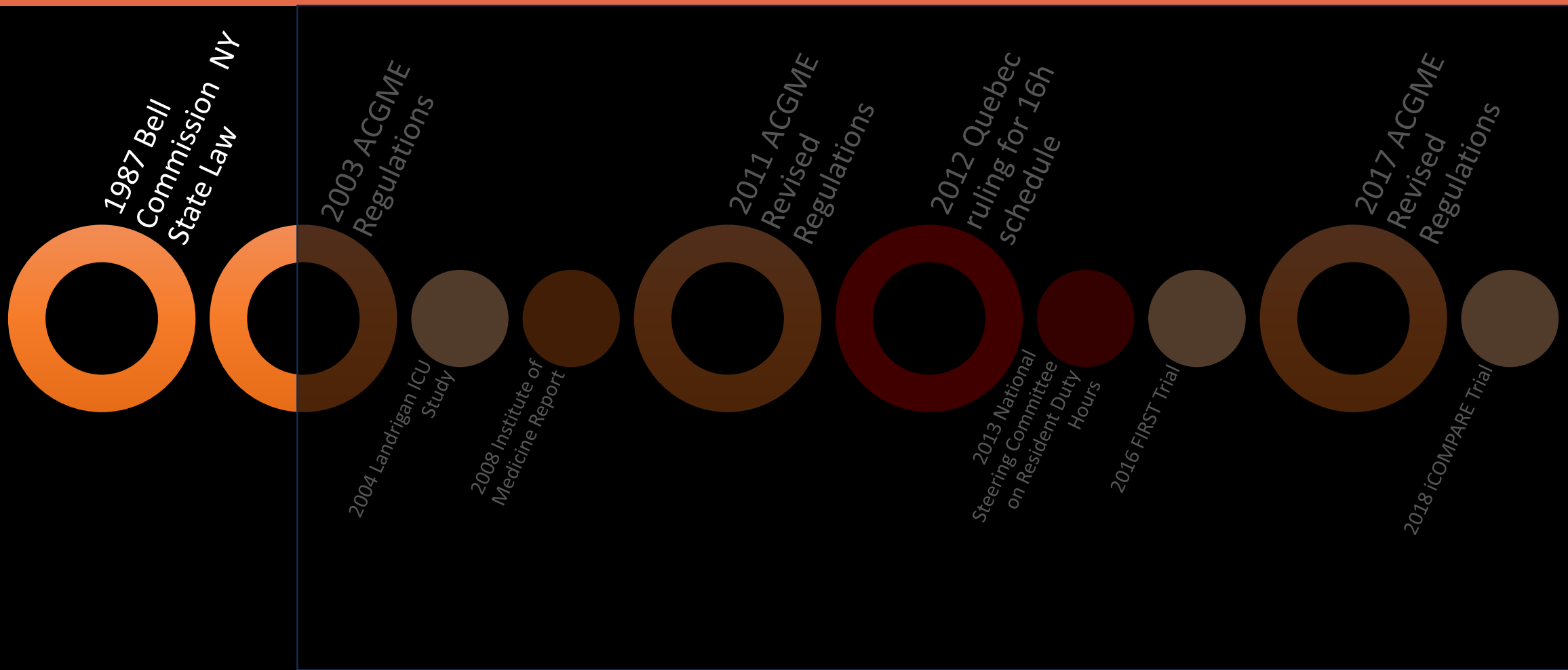
# Dilemma


LONGER DUTY HOURS
CONTINUITY OF CARE
PROVIDER FATIGUE
PROVIDER LEARNING
PROVIDER WELLBEING
PATIENT SAFETY

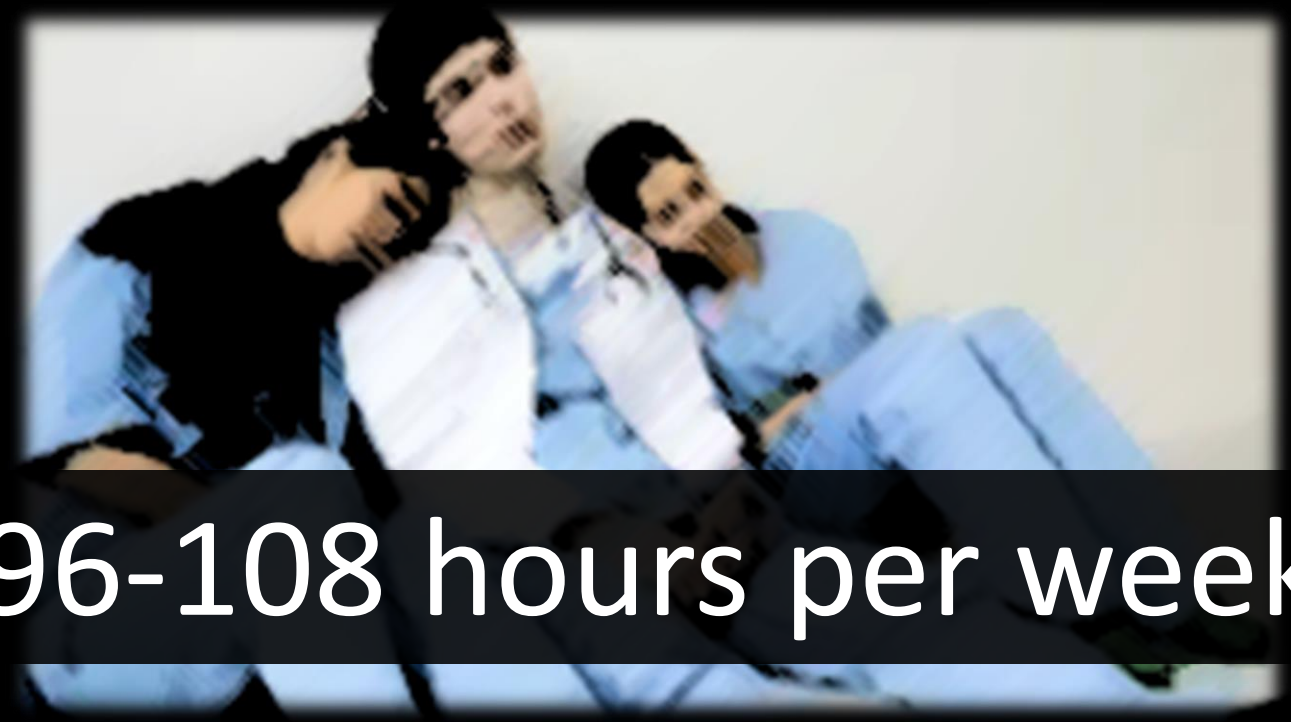
# 25 Years of REACTIVE Evidence Building



# Pre-2003: The More the Better Era



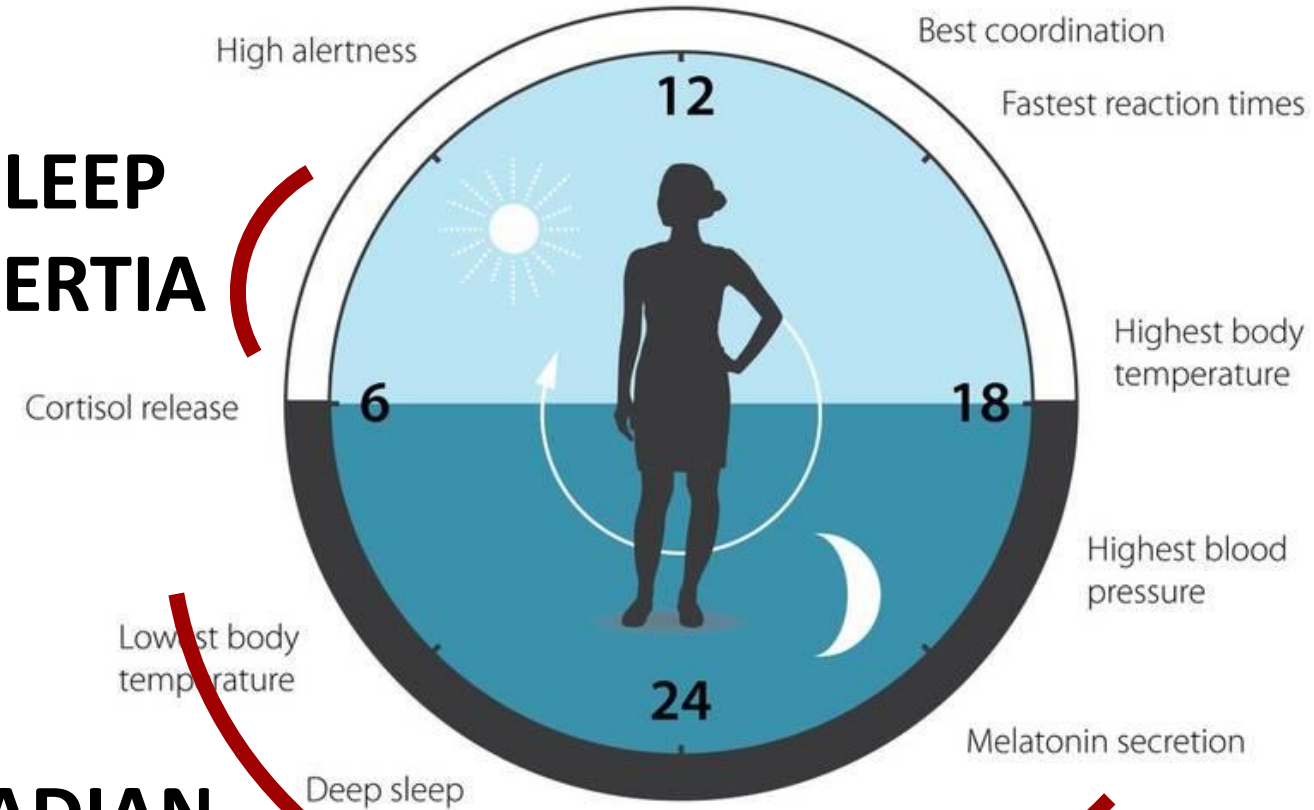
# Rising Concerns



96-108 hours per week

Pastores, CCM 2011

# WORK SCHEDULE AND SLEEP




**SLEEP INERTIA**

**CIRCADIAN MISALIGNMENT**

**SLEEP LOSS**

Wong Anes Anal 2018

# SLEEP LOSS AND HUMAN PERFORMANCE

- Attention
- Memory
- Reaction time
- Motor skills
- Injuries
- Judgement
  (including about their own performance)
- Sickness
- Mood

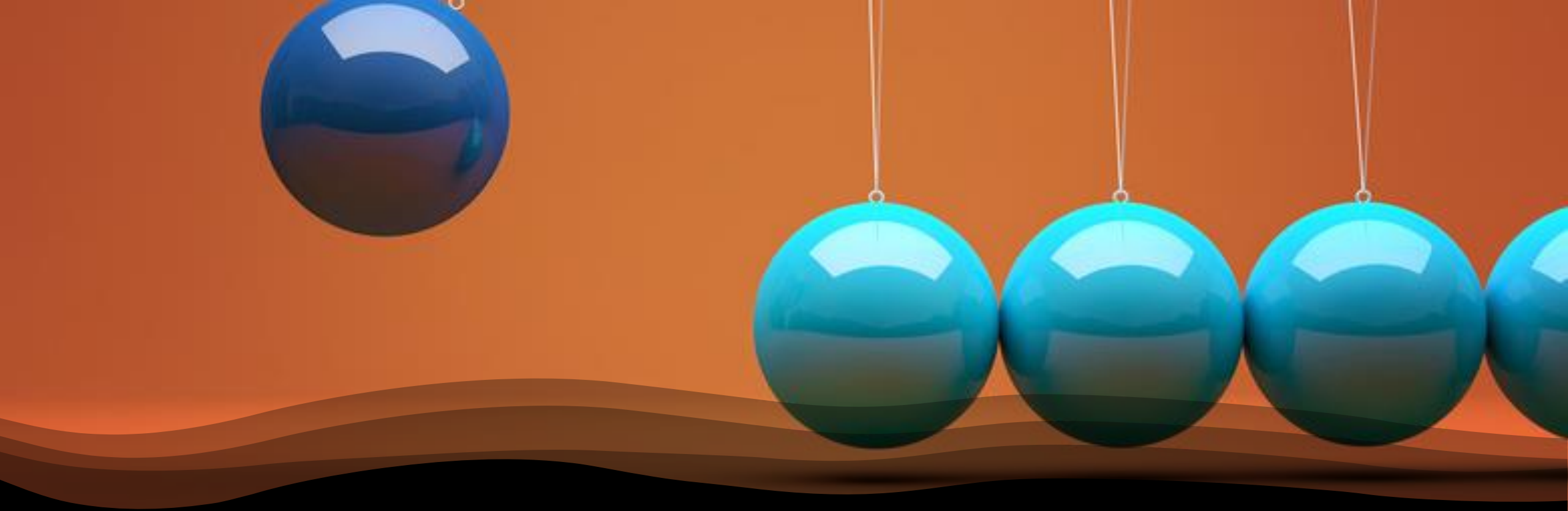
Wong Anes Anal 2018

# Case of Libby Zion

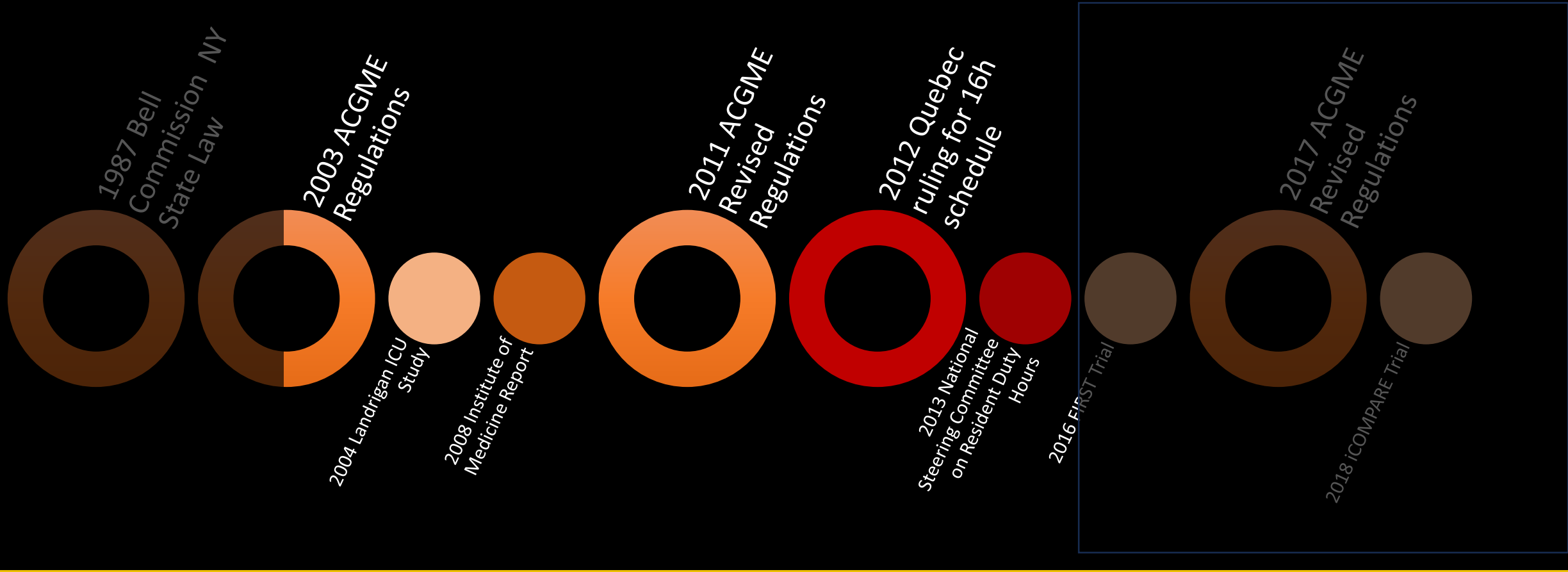
2003

24h/shift
80h/week

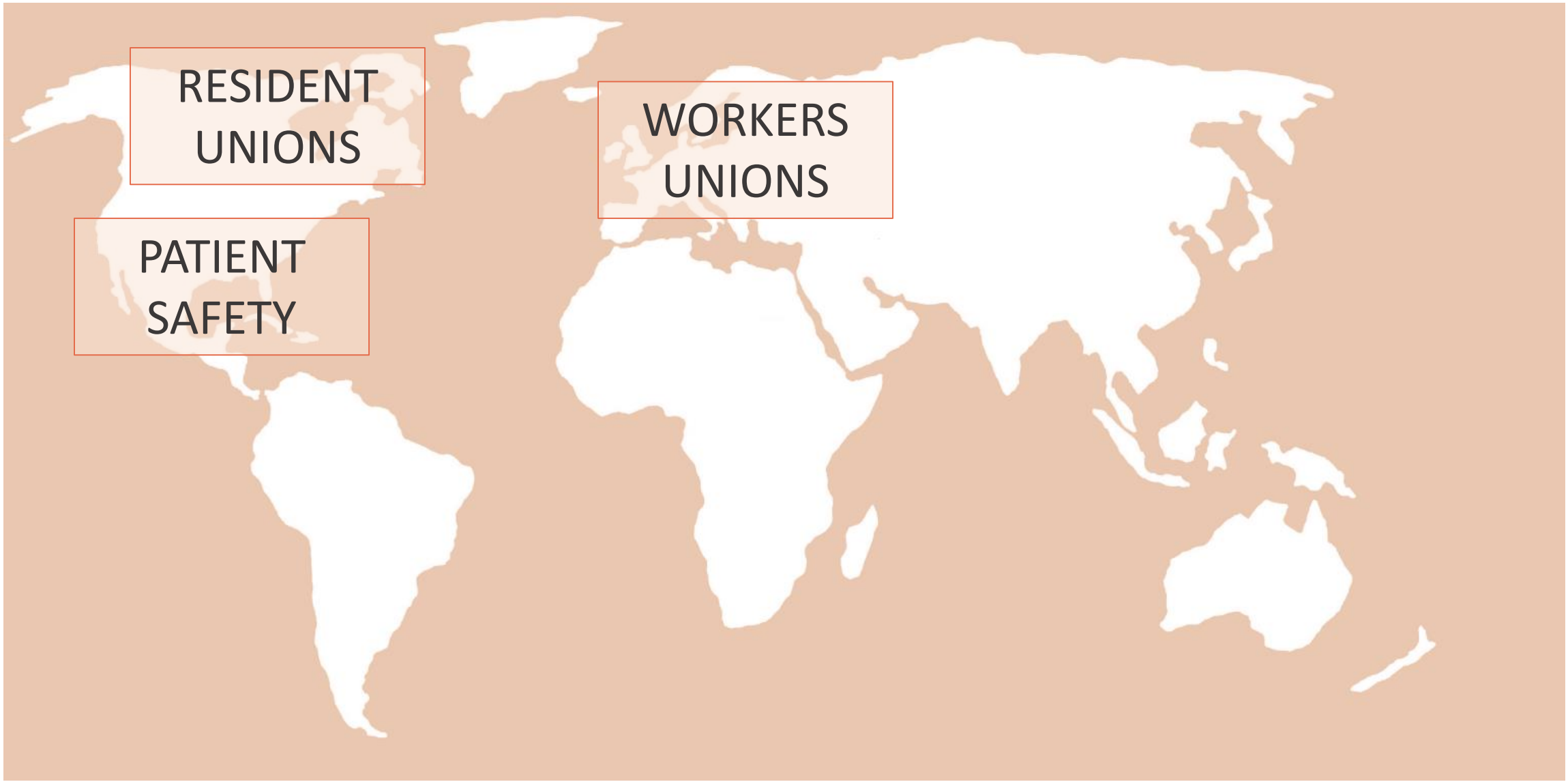
Accreditation Council for Graduate Medical Education



# More Is Better… but TOO MUCH IS DANGEROUS




# 2003-2013: “Less” Is Better Era




Woodrow, Acad Med 2006

# LANDRIGAN Study - NEJM 2004

2004 Landrigan ICU Study

2008 Institute of Medicine Report

**Fewer Serious Medical Errors**

By 20 **INTERNS**

with reduced shift length **(16h)**

in **2 US ICUs** of one hospital,

but also

**MORE SUPERVISION,**

**and 33% more INTERNS.**

| Variable | Traditional Schedule | Intervention Schedule | P Value |
|---|---|---|---|
| | *no. of errors (rate/1000 patient-days)* | | |
| **Serious medical errors made by interns** | | | |
| Serious medical errors | 176 (136.0) | 91 (100.1) | <0.001 |
| Preventable adverse events | 27 (20.9) | 15 (16.5) | 0.21 |

1987 Bell Commission NY State Law

2003 ACGME Regulations

2004 Landrigan ICU Study

2008 Institute of Medicine Report

2011 ACGME Revised Regulations

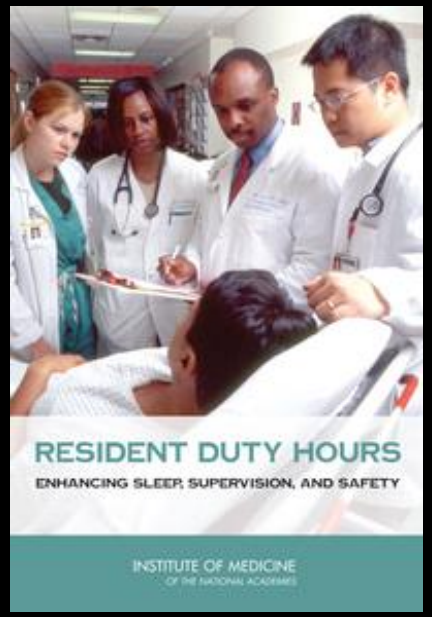
2012 Quebec ruling for 16h schedule

2013 National Steering Committee on Resident Duty Hours

2016 FIRST Trial

2017 ACGME Revised Regulations

2018 iCOMPARE Trial




2011

16h/shift
80h/week

Accreditation Council for Graduate Medical Education

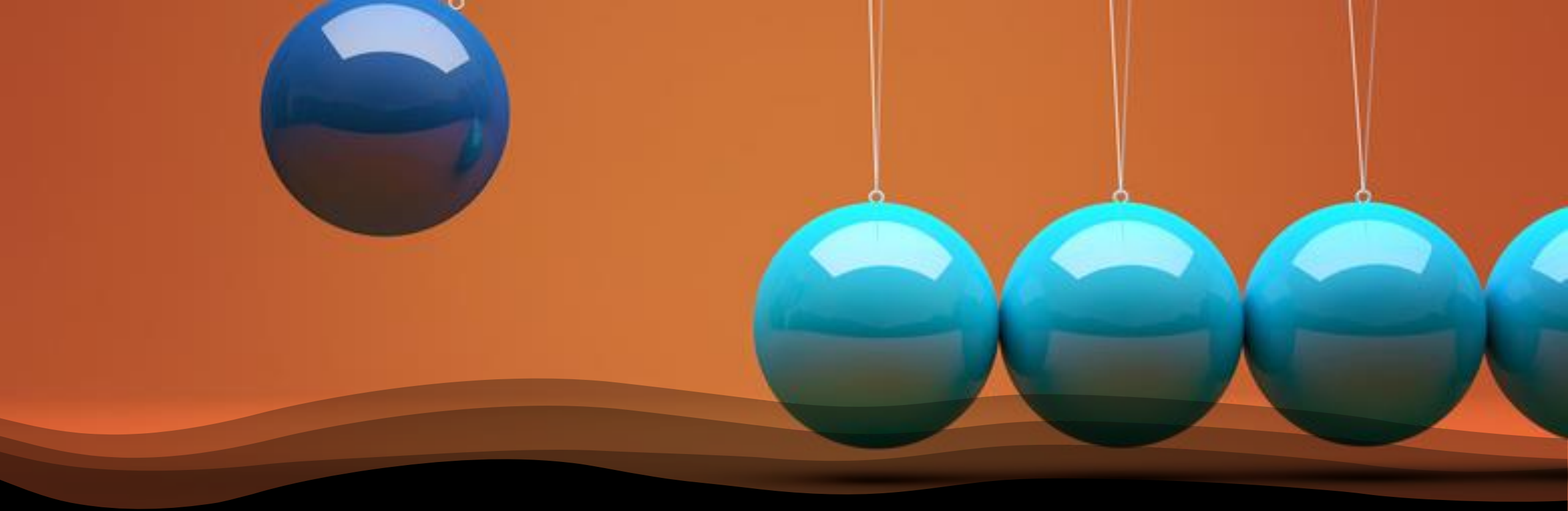
Systematic Reviews

## Table 2: Systematic Reviews of Interventions to Decrease Resident Work Hours

| Author | Fletcher | Reed | Levine | Moonesinghe | Fletcher | Jamal | Amhed | Bolster | Busireddy |
|---|---|---|---|---|---|---|---|---|---|
| Journal | JAMA | Ann Int Med | SLEEP | BMJ | J Gen Int Med | Br J Surg | Ann Surg | J Grad Med Ed | J Grad Med Ed |
| Published | 2005 | 2010 | 2010 | 2011 | 2011 | 2012 | 2014 | 2015 | 2017 |
| | 1966 - Apr | Jan 1989 - | Jan 1950 - | Jan 1990 - | 1989 - May | Jan 2000 - | | May 2010- Feb | Database |
| Number of Studies Included | 54 | 64 | 23 | 72 | 60 | 10 | 135 | 27 | 10 (on work hour limits) |
| Patient Outcomes[1] | | ↑ ↔ ↓ | ↑ ↔ | ↔ ↑ ↓ | ↔ ↑ ↓ | ↔ | ↓ ↔ ↑ | ↔ ↑ ↓ | |
| Education Outcomes[2] | ↑ ↔ ↓ | ↔ ↑ ↓ | ↔ ↑ ↓ | ↔ ↓ ↑ | ↔ ↑ ↓ | | ↓ ↔ ↑ | ↓ ↔ ↑ | |
| Wellbeing Outcomes[3] | ↑ ↔ ↓ | ↑ ↔ | ↑ ↔ | | ↑ ↔ | | ↑ ↔ ↓ | ↔ ↓ ↑ | ↑ ↔ |

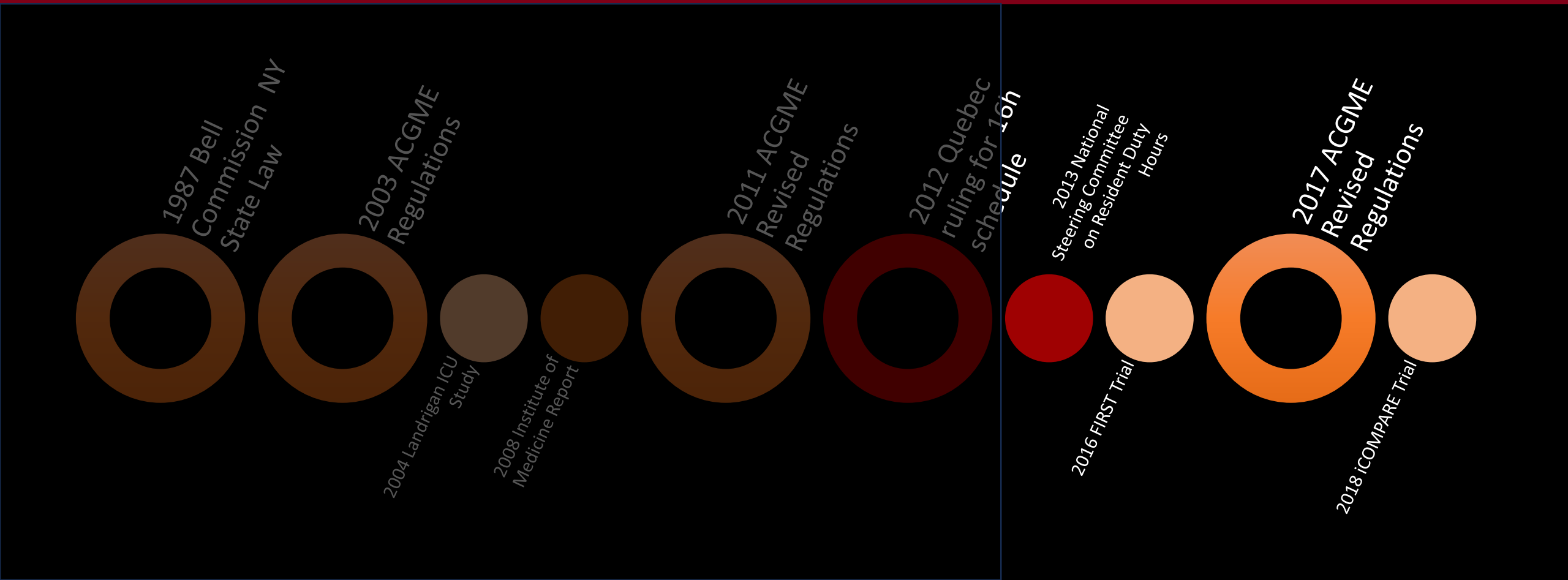
# Rising Concerns


Devitt 2018 Acad Med
Drolet 2014 J Grad Med Educ
Ferraris 2017 J Thor Cardiovasc Surg



# Less is not better…and MAYBE EVEN **WORSE!**

# Post-2013: The More Or Less Era



2013 National Steering Committee on Resident Duty Hours

2016 FIRST Trial

# The FIRST trial

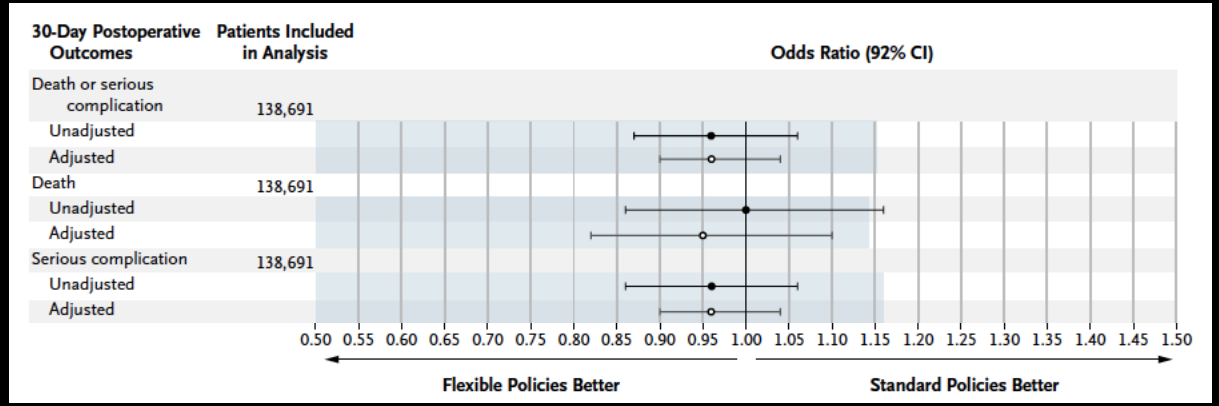
Non inferiority of

FLEXIBLE schedule

in 117 surgical US programs for patient outcomes

but also

more 80h violations and **poorer personal health** [especially in women].




Bilimoria NEJM 2016x

# The iCOMPARE trial

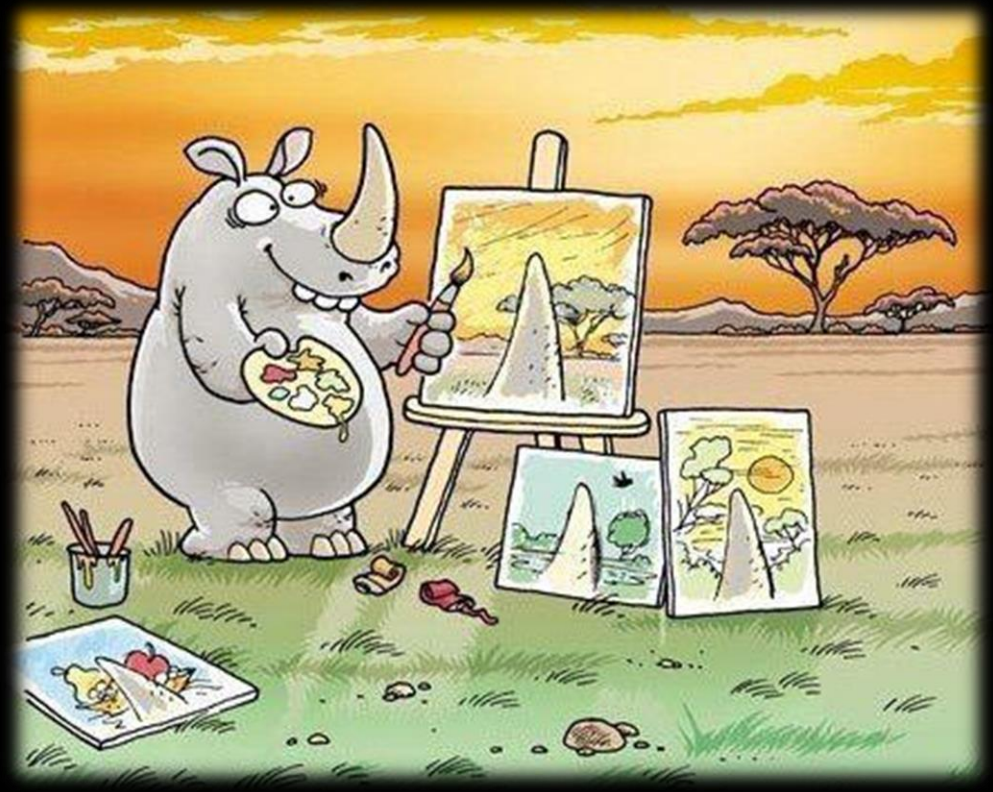
Non inferiority of

FLEXIBLE schedule

in 63 medicine US programs
for patient **30-day mortality**

but also

more interns' dissatisfaction
with **education** and **wellbeing**
(not shared by PDs).



Desai NEJM 2018
Silber NEJM 2019

2017

24h+/shift
80h/week

Accreditation Council for Graduate Medical Education

# LONGER DUTY HOURS…

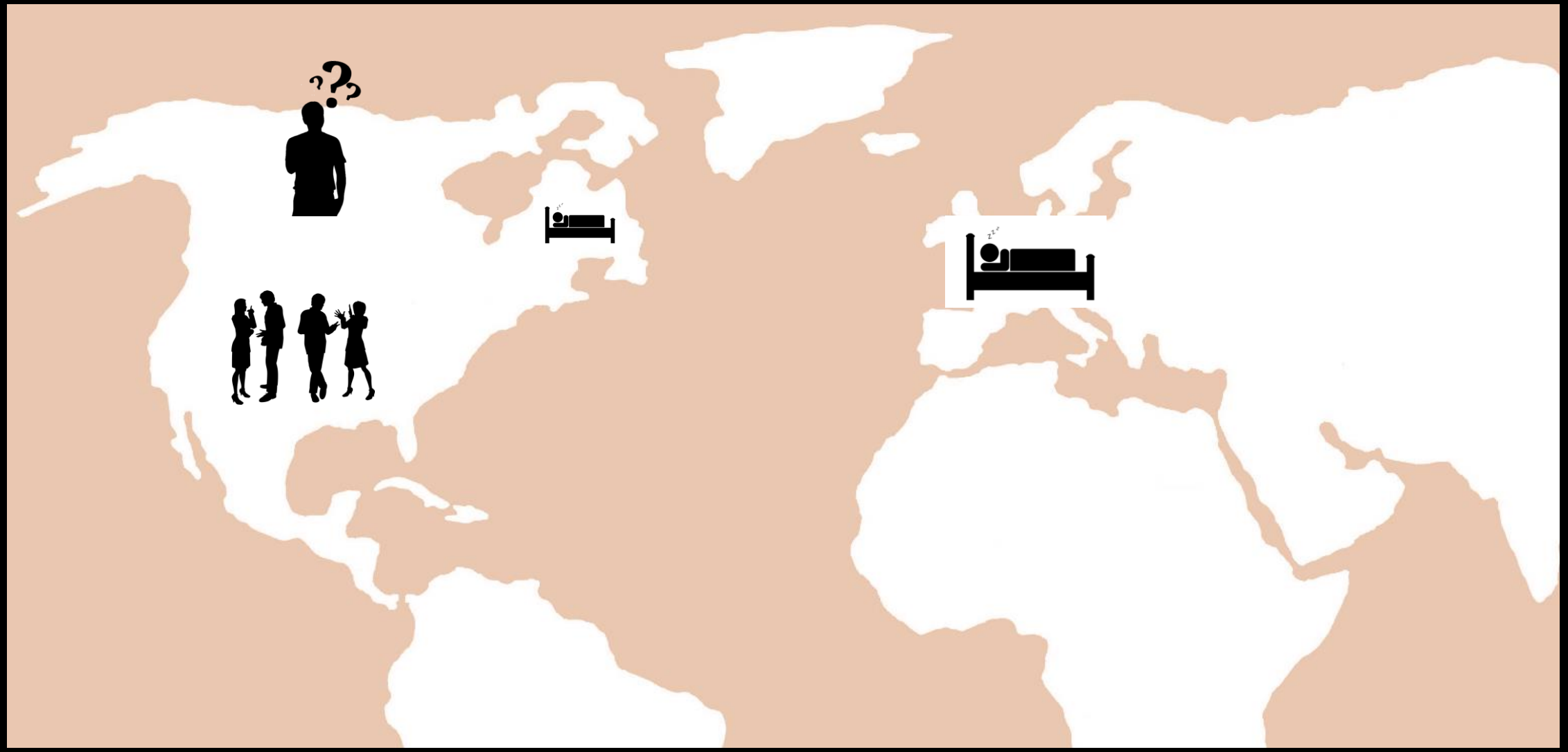
… not worse for patient care.

… worse for resident wellbeing.

… better for staff & sr. trainees.

Weiss, 2018 Sleep Health
Chung, 2018 Health Serv Research
Corey, 2017 J Surg Educ
Arora, JGIM 2019
Roshestky, Acad Med 2013

# What about Canada?



ations

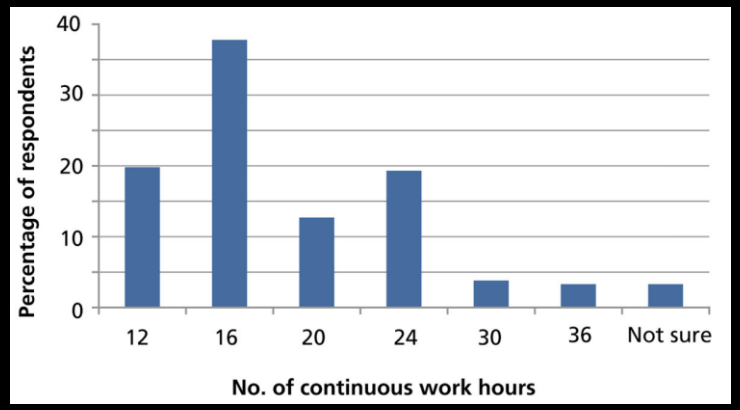
2012 Quebec ruling for 16h schedule

2013 National Steering Committee on Resident Duty Hours

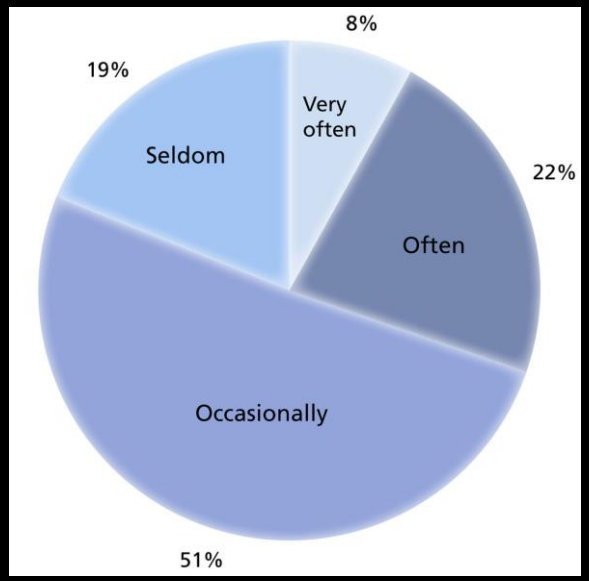

# Canadian Steering Committee

"In order to ensure decisions regarding patient care and residency work environments … further research regarding the impact of resident duty hours, particularly in light of the unique Canadian context, must be undertaken."

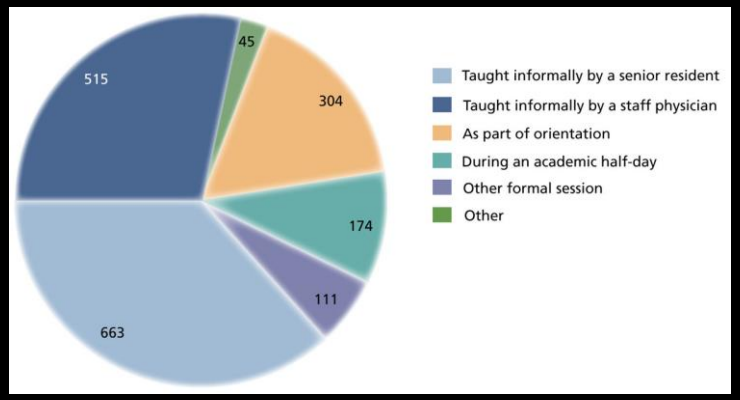
Masterson BMC Med Educ 2014




Maximum Period of Safe Care

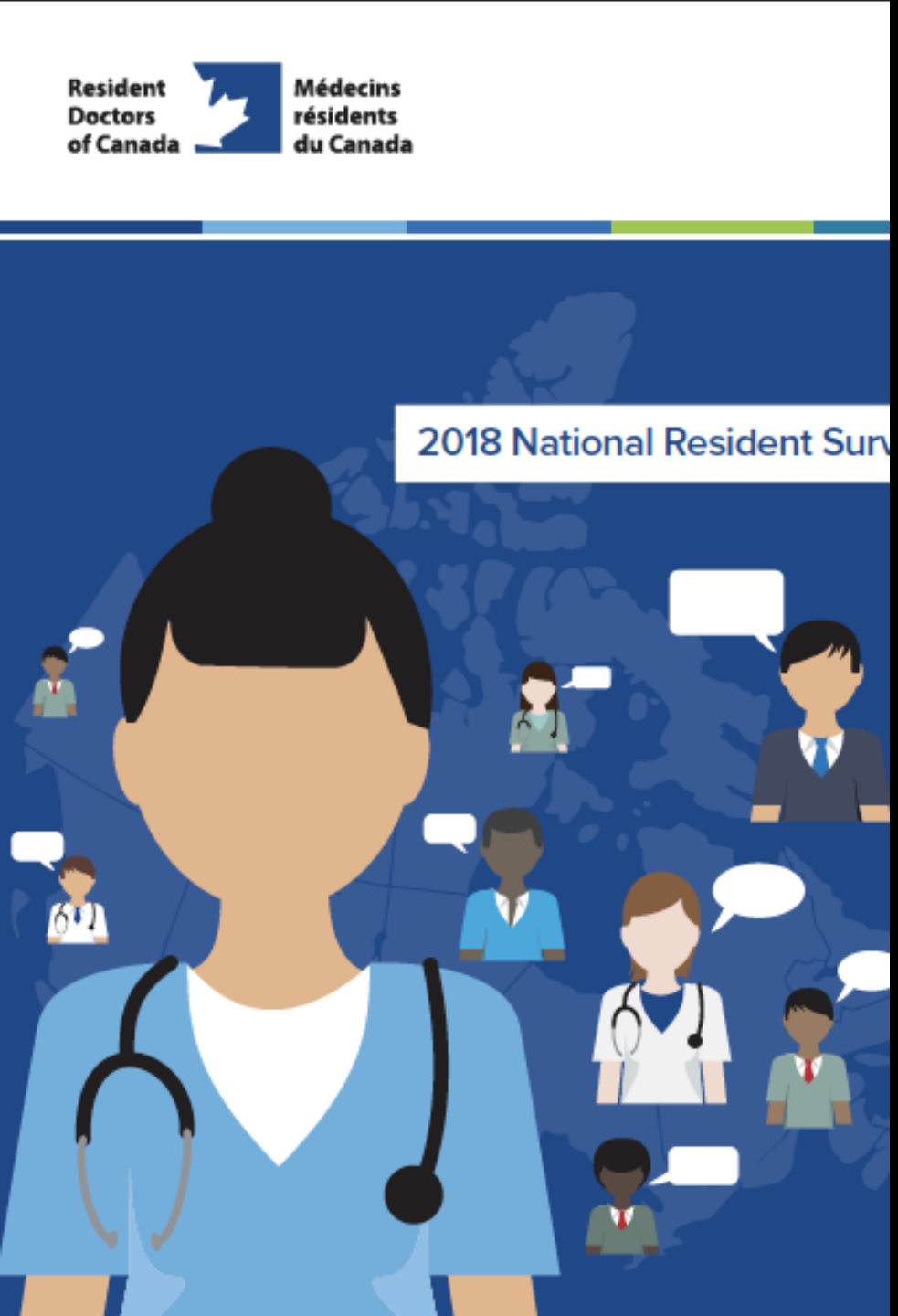



Long Hours Compromising Care




Handover Training

# Canadian Resident Opinion




# Current Resident Wellbeing

- 72% work > 60h / week
- 70 % trouble sleeping
- 20% report mistakes because of fatigue
- 52% symptoms of burnout
- 75% victims of harassment and intimidation
- 10-13% depression symptoms and suicidal thoughts/plans

Resident Doctors of Canada | Médecins résidents du Canada

POSITION PAPER

# Canadian Patient and Physician Safety and Wellbeing: Resident Duty Hours

April 2012

residentdoctors.ca

Resident physicians' duty hours must be managed such that they do not in any way endanger their health or the health of patients. In particular, limits are required on the number of continuous uninterrupted hours that residents are on duty. In keeping with current evidence, RDoC urges that all provinces and regions in Canada work towards a system that limits continuous uninterrupted duty hours to 16 hours or less at a time.[III] Additionally, the scheduling of duty hours must allow for adequate time in-between work periods to eliminate the effects of sleep deprivation. This limitation will enhance residents' ability to provide safe, high quality patient care, while protecting their own personal health and safety.

Resident duty hours must be such as to allow for an optimal educational experience. Specifically, trainees' duty hours must not impair their ability to learn or to train others.

Residents must be formally trained in handover skills, the ability to transfer care appropriately when going off duty.

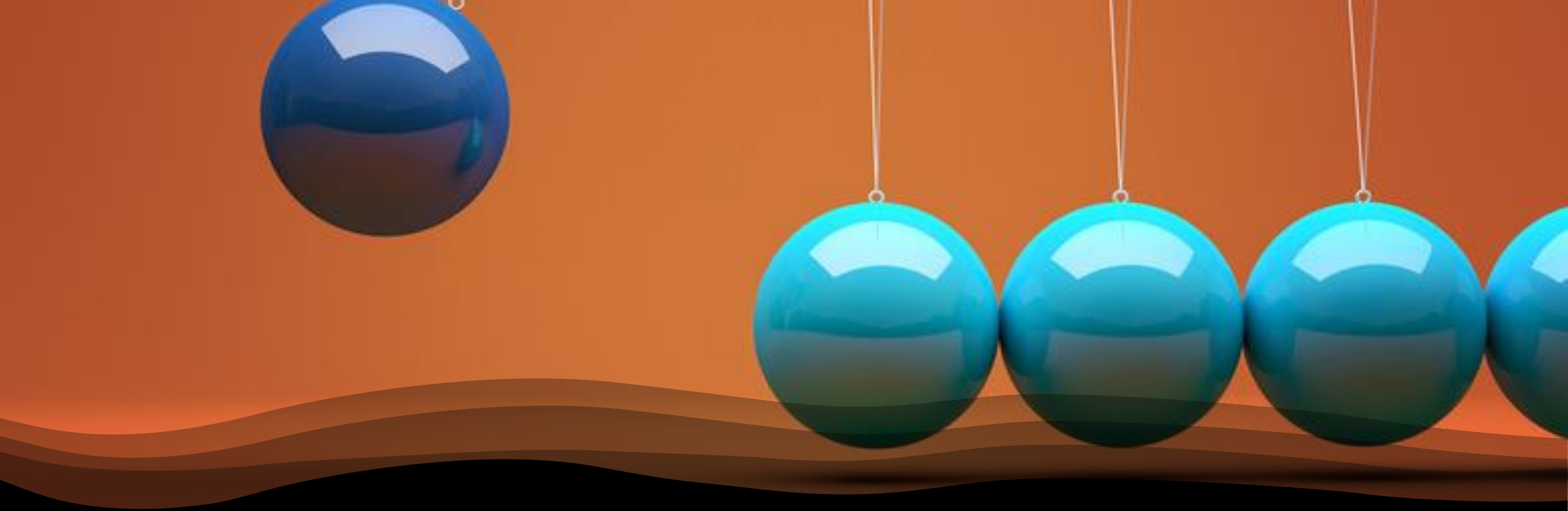
# Societal Expectations

Quebec Population (2010):

92% AGAINST shifts >16h

72% FOR informing patient if shift > 16h

Dussault BMC Med Ed 2014



# MORE EMPIRICAL DATA…?

# InCURS

## Intensive Care Unit Resident Scheduling trial

# OBJECTIVE

To evaluate the effects of

**16-hour and 24-hour**

overnight work schedule

on

patient mortality and safety,

resident education

and

resident wellbeing.

# Co-Intervention: Structured Handover

I-SHaRe
ICU Handover Study

## ICU-PASS HANDOVER

1 **Illness Severity**

Stable: No concern
Watcher: Potential concerns
Unstable: Active concerns

2 **Patient Summary**


Reason & Duration of ICU admission
List of active issues
**Relevant for the night**

3 **Action List**


To do list
By priority
Timeline & Ownership

4 **Situation Awareness & Contingency Plan**

What could go wrong?
What is the plan if things go wrong?

5 **Synthesis by Receiver**

Active listening
Questions

I-PASS
BETTER HANDOFFS. SAFER CARE.

# CHALLENGES

- Fewer residents rotating in the ICU
- Fellow/faculty burnout
- Programs under accreditation review
- Unilateral adoption of shorter duty hours

# Continuity of Care Comes at a Cost

For the trainees, the faculty, the staff, the patients

# Thank you for your attention

dominique.piquette@sunnybrook.ca

# Thank you for joining us today

Feedback?
Suggestions for the next topic?

**Submit ideas in our evaluation survey (Link in chat)**

Subscribe

**Critical Care Services Ontario**

Questions? **info@ccso.ca**

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