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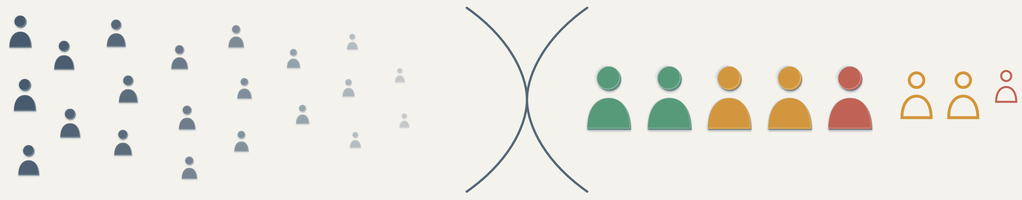
APPLIED HEALTH ECONOMICS · HTA METHODOLOGY

The Traffic Light Framework.

Incorporating healthcare personnel scarcity into health technology assessment: a three-zone decision rule for when to use average cost, scarcity-adjusted marginal cost, or a feasibility assessment.



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EU-HEM European Master in Health Economics & Management · Roche Norway Market Access internship, Sep–Dec 2025

HTA personnel costing should match the state of the workforce: average cost when personnel are available, scarcity-adjusted marginal cost when supply is constrained but elastic, and a feasibility assessment before interpreting the ICER when supply is binding.

01 Background.

PUBLIC HEALTH RELEVANCE

Norway projects a shortage of **~180,000** healthcare personnel by 2060 (*Meld. St. 31, 2023*, p. 12; NOU 2023:4). Vacancies in human-health activities rose from **2.2%** (2017) to **3.2%** (2024) of total job posts (Statistics Norway / SSB Statbank Table 08836).

The 2025 prioritisation white paper (*Meld. St. 21*) extends the resource criterion to include personnel impact. In conventional HTA costing, however, clinical time is commonly valued at **average cost**, which can understate the opportunity cost of scarce personnel and obscure whether an intervention can in fact be delivered.

02 Objective.

RESEARCH QUESTION

When should an HTA use **average personnel cost**, a **scarcity-adjusted marginal cost**, or a **feasibility assessment** for healthcare personnel time?

We responded to a 2025 Norwegian health-ministry assignment on personnel impact in prioritisation by translating van Baal, Morton & Severens' (2018) input-constraint theory into a transparent, decision-ready rule usable by Norwegian HTA reviewers without re-modelling each submission.

03 Methods.

MIXED-METHODS, DESIGN-THINKING PROCESS

Five-stage design-thinking process during an EU-HEM curriculum internship hosted by Roche Norway Market Access; targeted policy & literature review, semi-structured interviews with **3 academic experts + 1 Norwegian decision-maker**; framework parameterised with public Norwegian wage / overtime / agency data; applied to three illustrative HTA-relevant scenarios.

Empirical anchors: CFOs in the regional health authorities estimated a **+14%** personnel-cost increase under 10% activity growth (Oslo Economics for the Norwegian Ministry of Health and Care Services; Kittelsen, Anthun & Magnussen 2024, n=17 CFOs); Norwegian managers reported meeting temporary-staffing needs via **83%** extra shifts vs **17%** agency hire (Fafo; Moland, Tofteng & Nesland 2023, n=1 351).

01 · EMPATHISE	02 · DEFINE	03 · IDEATE	04 · PROTOTYPE	05 · TEST
Targeted policy + literature review (HTA costing, workforce constraints)	Semi-structured interviews with academic & Norwegian decision-maker stakeholders	Three-zone decision rule for personnel supply states (Green / Amber / Red)	Marginal-cost parameterisation: wage + overtime + agency premia (Statistics Norway, Fafo)	Three illustrative scenario applications across specialist & municipal care

SCENARIO	SHARE OF NEW STAFF-HOURS · WAGE · OVERTIME · AGENCY	MARGINAL COST NOK/H	UPLIFT
Low	60% · 30% · 10%	1012	+25%
Moderate	30% · 40% · 30%	1281	+58%
High	60% · 40%	1456	+80%

Average cost = 810 NOK/h (DMP 2025 weighted SSB wage) · **Overtime** ×1.33 (UTA scheme) · **Agency** ×2.5 (Moland et al. 2023). The Amber zone applies a **proposed transparent sensitivity range** of **30–50%** to the *personnel cost component* only; this is an illustrative range, not calibrated or official guidance. Worked examples use **30%** as the conservative lower bound.

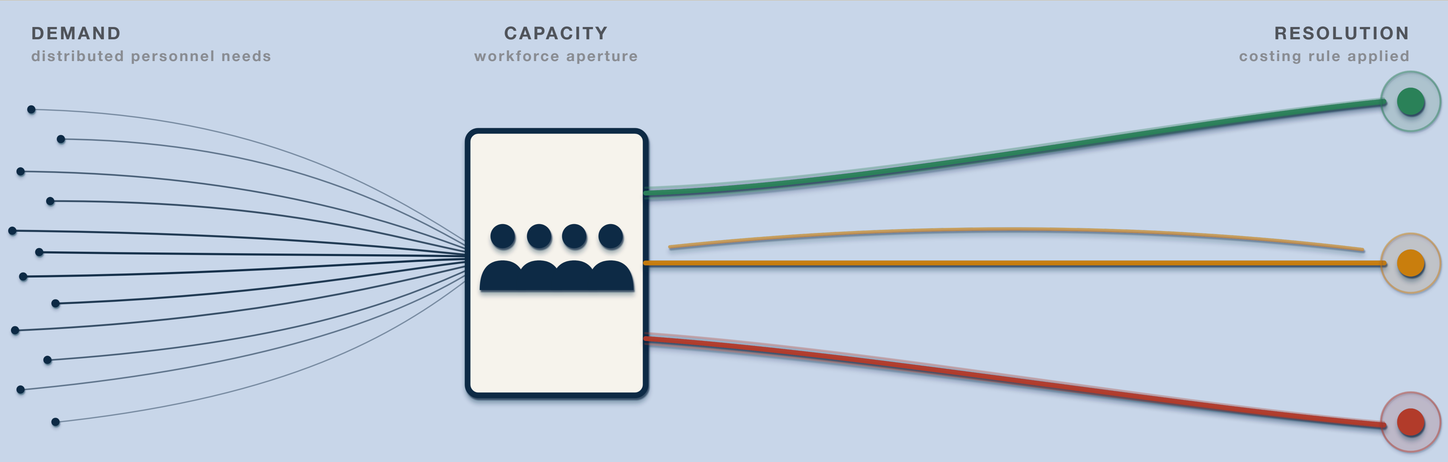
Average wage · Overtime · Agency

04 Framework: one decision rule.

FIGURE 1 · THREE-ZONE HTA PERSONNEL-COSTING RULE

FIGURE 1 The Traffic Light Framework. Distributed personnel demand passes through a finite staff-capacity aperture and resolves into one of three costing rules according to the state of workforce supply.

Adapted from van Baal, Morton & Severens (2018).



Green SUPPLY AVAILABLE

When: staff available within normal capacity.

Use standard average costs. No uplift; no feasibility test.

`Cost = average cost`

Amber SUPPLY CONSTRAINED BUT ELASTIC

When: constrained but expandable via overtime, temporary staffing, or reallocation.

Apply a proposed sensitivity range (30–50%) to the personnel component of cost; sensitivity-test bounds.

`Marginal personnel cost = (1 + uplift) × average personnel cost`

Red

SUPPLY BINDING · FEASIBILITY CHECKPOINT

When: required personnel unavailable within the implementation horizon.

Feasibility assessment alongside CEA; consider phasing options.

`Feasibility first. Then CEA.`

05 Results: three illustrative scenario analyses.

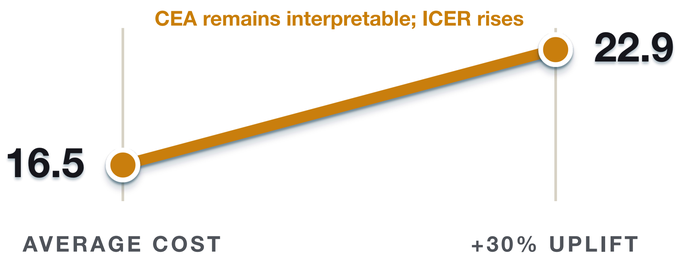
FIGURES 2A–2C · SCENARIOS MAPPED TO FRAMEWORK ZONES

FIGURE 2A · MENTAL HEALTH — AMBER

Adolescent internet-delivered ERT for NSSI.

Personnel-intensive therapist time; Amber 30% uplift applied to personnel component (Bjureberg et al. 2025).

16.5 → 22.9
M NOK / QALY



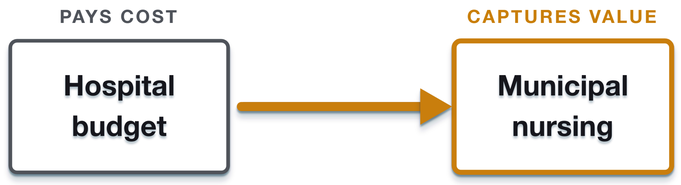
The personnel uplift moves the ICER upward substantially; interpretation depends on the applicable **threshold and severity context**.

FIGURE 2B · ALZHEIMER'S DMT — AMBER

Disease-modifying therapy; mild → moderate delay.

Hospital pays; municipal nursing captures freed time. **German G-BA nursing-time proxy**; not Norwegian empirical evidence.

+64,000 NOK
proxy value per patient-year (German G-BA nursing-time proxy)

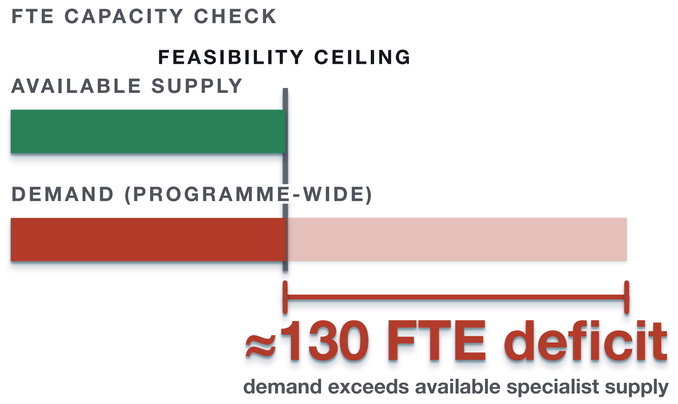


Marginal-cost valuation makes the **cross-sectoral wrong-pocket value** legible to the HTA decision-maker.

FIGURE 2C · COLORECTAL SCREENING — RED

National primary-colonoscopy screening.

Combined endoscopy-workforce deficit (specialists + assistants); supply not expandable by price alone within the implementation horizon.



May appear favourable under conventional costing, but **requires feasibility and phasing** when personnel supply is binding: a Red-zone **binding implementation constraint**.

06 Implications for HTA practice.

DECISION RULE ABOUT *WHICH METHOD* TO USE; NOT A NEW MODEL

Green SUPPLY AVAILABLE

Use standard average personnel costs; no new evidence burden on submissions.

COST = AVERAGE COST

Amber CONSTRAINED BUT ELASTIC

Add a transparent personnel-cost sensitivity range (30–50%) to the personnel cost component, with the uplift composition reported explicitly.

SENSITIVITY-TEST BOUNDS · PERSONNEL COMPONENT ONLY

Red SUPPLY BINDING

Add a personnel-feasibility assessment *alongside* CEA, with phasing options and an operational timeline.

FEASIBILITY FIRST · THEN CEA

07 Limitations.

WHAT THIS WORK IS, AND IS NOT

The Traffic Light Framework is an EU-HEM student research proposal from a curriculum internship project, intended as a transparent decision aid; not official Norwegian HTA guidance.

- **EU-HEM student / curriculum-internship proposal.** Not an official methodology of Roche, DMP (Norwegian Medical Products Agency), Helsedirektoratet, SMDM, or any Norwegian government body.
- **Limited stakeholder engagement.** 3 academic experts + 1 Norwegian decision-maker; not a national consensus or Delphi process.
- **Proposed sensitivity range (30–50%).** Illustrative and conservative; *not* a calibrated or official Norwegian parameter, and applies to the personnel cost component only.
- **Scenario analyses are parameterised, not estimated.** ICER and FTE values are illustrative; they should be validated with Norwegian workforce & implementation data before policy use.
- **Proxy inputs flagged.** The Alzheimer's nursing-time estimate uses a German G-BA proxy, not Norwegian empirical evidence.

READINESS CHECKPOINT · VALIDATION NEEDED BEFORE GUIDANCE

Policy-ready validation.

Four open work-streams the framework needs before it could inform official Norwegian HTA practice.

01 Regional granularity — VALIDATION NEEDED
Differentiate rural municipalities from central university hospitals.

02 Staff-supply elasticity — VALIDATION NEEDED
Estimate how easily each staff group can expand before reaching the feasibility threshold.

03 Unit-cost / DRG route — VALIDATION NEEDED
Apply the method when personnel time is embedded in diagnosis-related group (DRG) tariffs.

04 Periodic recalibration — VALIDATION NEEDED
Revisit uplift factors as workforce scarcity and service models change.

08 Conclusion.

POLICY IMPLICATIONS

HTA personnel costing should **match the state of workforce supply. Average cost** remains correct under Green-zone availability; a **scarcity-adjusted marginal cost** better reflects the opportunity cost of constrained-but-elastic personnel time; and under binding constraints, the relevant question is not *"is it cost-effective?"* but *"can it be implemented at all?"*

Green → cost · Amber → adjust · Red → check feasibility first

KEY TAKEAWAY

Match the costing method to the workforce, so HTA distinguishes value from implementability when workforce constraints bind.

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This work was developed as part of the EU-HEM curriculum during a student internship hosted by Roche Norway Market Access, September–December 2025. **Supervisors Audun Ohna and Kristin Krogsrud are Roche Norway employees**; both provided internship supervision, including discussion of the research question and review of scientific content.

Disclosure. The Traffic Light Framework is a student research proposal. It does **not** represent the official methodology of Roche, DMP (Norwegian Medical Products Agency), Helsedirektoratet, SMDM, or any Norwegian government body. No additional conflicts are declared.