

# Optimizing home visit scheduling for family interventions: balancing service delivery and technician well-being

**Isabel Gomes**

NovaMATH + Department of Mathematics

NOVA School of Science and Technology

Lisbon, Portugal

# Outline

- Home social intervention for families with vulnerable children
- The problem and some case study details
- The model
- Results
  - proposed plan
  - current plan vs. proposed plan
  - workload distribution
- Final remarks

# Context

Several factors have been **increasing the demand for Family Interventions**

- Increasing trend of referrals for emotional abuse and neglect
- Awareness of the negative consequences of children's institutionalization
- Long-term societal impact

Shift towards **community-based (proximity) services**, with family-centered interventions and multidisciplinary approaches

The **organizations** providing these services **are frequently not for profit** and have difficulty in answering the rise in demand

- They present low levels of operational efficiency
- Resources are shared between services, making it hard to plan manually

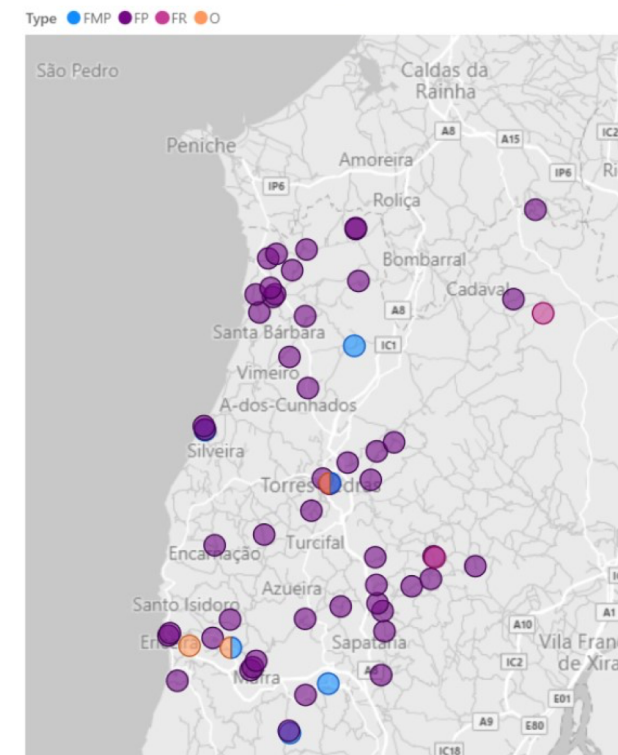
# Context

## Home social intervention for families with vulnerable children

Social Intervention: To develop the social and emotional skills necessary for families to change negative dynamics

- Family Reunion (FR) – supervision of the return of the child to the family environment after a period of removal
- Family Meeting Point (FMP) – neutral and appropriate space aimed at maintaining or re-establishing family ties
- Family Preservation (FP) – aims to prevent child removal from the family, mostly done by home visits

**For the CAFAP of ComDignitatis, we are studying how to improve the planning of home visits for FR and FP.**



# Problem

Problem:

To produce a tactical baseline plan for home visits. How to assign visits to teams and when to schedule them to meet service standards

Objectives:

- To improve the assignment of technicians to visits, and the visits scheduling
  - Increase the number of visits per outing
  - To balance workload
- To model work regulations in the context of **worktime exemption**
- To consider technician's **work-life balance**

Technicians can work three slots in a row but must be compensated in hours

Slot \ day	Mon	Tue	Wed	Thu	Fri
Morning	Home Visit	X	Occupied	Home Visit	Occupied
Afternoon	Occupied	Occupied	Occupied	Home Visit	Home Visit
Evening	Home Visit				

Disrupts technicians' work-life balance

# Case study data

Data reports to January 2022 – March 2022

53 Families: **40 families associated to two techs & 13 associated to three techs**

- Availability
- Time interval between consecutive visits  $[T_i^{min}, T_i^{max}]$ , 1h per visits

six technicians – two trainees and four senior technicians

- Work 35h/week (10 slots), not all assigned to home visits.
- Availability

Planning Horizon: three months, services on weekdays. **Each day has three slots.**

- 120 slots per technician (40 slots per month, 10 slots per week)

Technician	Number of families
a1	19
a2	23
a3	21
a4	29
a5	3
a6	25

Slots	Time-Windows
Morning	9:00 – 12:00
Afternoon	13:30 – 16:30
Evening	17:00 – 20:00

# The model *in words*

**Bi-objective** multi-period assignment and scheduling problem

**$Z_1$  - Service quality (maximizing the number of visits)**

- Penalize surpassing maximum limit of interval between visits

**$Z_2$  - Workload concerns (minimizing the maximum workload)**

- Penalize the use of **inconvenient slots**

Solved through a **lexicographic approach** (GAMS + Gurobi)

de Aguiar AR et al. (2025). Home visit scheduling for family interventions: a child protection case study. *International Transactions in Operational Research*, 32: 669-691.

# The model *in words*

## Scheduling

- 3 daily visit slots with a maximum of 2 visits per slot by same team
- 2 families visits in a slot distance at most 20km
- Technicians and families' availabilities are considered
- Families already assigned to a small set of Technicians
- Consecutive visits within pre-established time interval
- Minimum of 1 visit per family in planning horizon

## Work Regulations

- Technicians should work no more than 40 slots per month
  - Assured weekly to avoid workload concentration

## Skill Level

- Trainees can only perform visits with a senior technician



# Results: Proposed plan

Weekly team meeting

Monday of week 2 technicians a4 & a6 visit family i7 between 9 am and 12 pm

week 1	t1	t2	t3	t4	t5
s1	a4+a6: {i49, i53}	Meeting	a3+a4: {i2, i42}	a2+a3: {i13, i28}	a2+a3: {i36}
s2	a2+a6: {i27, i34}	a2+a4: {i3, i43}	-	a3+a4: {i20, i46}	a4+a6: {i5, i12}
s3	a3+a4: {i22}	a2+a6: {i9, i18}	a4+a5: {i37}	a3+a4: {i50, i21}	a2+a6: {i48}
week 2	t6	t7	t8	t9	t10
s1	a4+a6: {i7}	Meeting	-	a3+a6: {i35}	a2+a4: {i47}
s2	a2+a4: {i16, i33}	a2+a5: {i32}	a2+a5: {i6}	a3+a4: {i4, i30}	a2+a6: {i1, i17}
s3	a3+a4: {i24, i44}	-	a4+a6: {i45}	a3+a6: {i29}	-
week 3	t11	t12	t13	t14	t15
s1	a2+a4: {i52}	Meeting	a3+a4: {i15}	a3+a4: {i2, i42}	a2+a3: {i13}
s2	a2+a6: {i23, i40}	a2+a3: {i39}	a4+a6: {i49}	-	a3+a4: {i22, i53}
s3	a4+a5: {i10}	-	a2+a4: {i3}	a2+a4: {i11, i25}	a2+a6: {i27}
week 4	t16	t17	t18	t19	t20
s1	a3+a4: {i12}	Meeting	a2+a3: {i28}	a2+a3: {i36}	a3+a4: {i50}
s2	a2+a4: {i43}	-	a2+a4: {i32}	a3+a4: {i20, i46}	a2+a4: {i16, i33}
s3	a4+a6: {i37}	-	a2+a6: {i9, i18}	a3+a4: {i21}	-

Two families being visited by the same team within allowed interval

# Results

## Performance indicators: **Service Quality**

	Current plan	Proposed plan	Variation	
#visits	56	203	263%	Total number of visits scheduled
Capacity used (%)	57%	83%	25pp	% of slots used, both with home visits or other activities
#DoubleVisits	8	67	738%	Number of slots with two visits scheduled

# Results

## Performance indicators: **Workload Concerns**

	Current plan	Proposed plan	Variation	
Max #visits	37	112	203%	Maximum no. of visits performed by one technician
Max #HV slots	29	77	166%	Maximum no. of slots dedicated home visits for one technician
Max capacity	74%	99%	25pp	Maximum no. of slots used by a technician, both with home visits and other activities, as a percentage of the total available slots

# Results

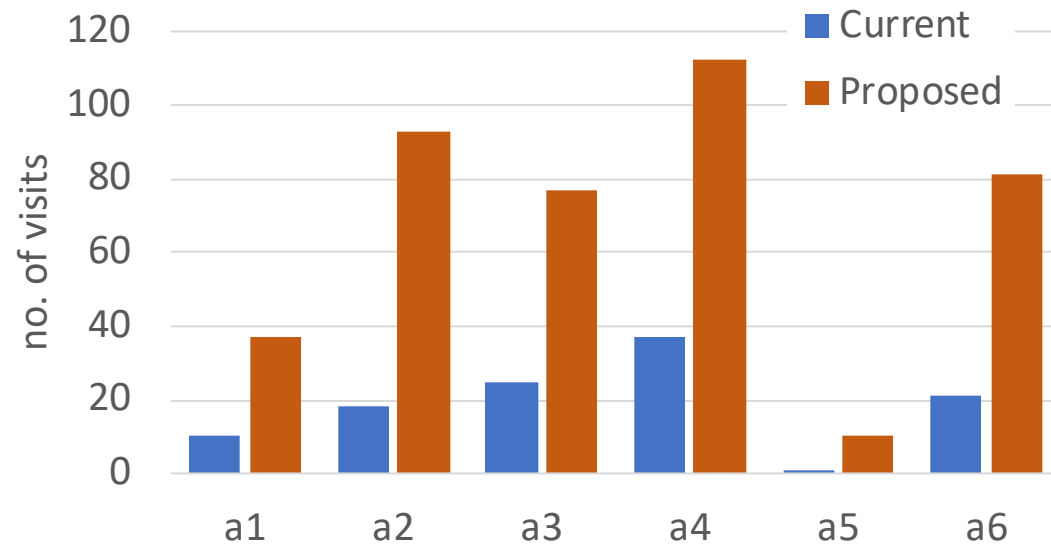
## Performance indicators: **Technicians' preferences**

	Current plan	Proposed plan	Variation
#inconvenience	18	72	300%
Max #inconvenience	5	24	380%

Total number of times at least one visit is scheduled in the evening slot of a technician

Maximum no. of times, at least, one visit is scheduled in the evening slot of a technician

# Results: Workload among technicians



The relative distribution remains very similar, despite the increase in number

Some technicians are close to having 100% of their *capacity* (120 visits) used

The assignment of the technicians to the families was not a decision of the model

# Final remarks

This was our first approach to this problem. Now we are:

- Considering the assignment of families to technicians aiming at a more balanced workload distribution among technicians
- Develop a rescheduling approach. There are many cancellations, both from technicians (e.g., required court appearances) and from families.
- Modeling technician **preferences as a third objective** rather than it being modeled as a soft constraint.

This was the first time the technicians saw a Tactical Plan of their visiting service

# TEAM



Inês Clode Grassi  
MSc student



Ana Raquel Aguiar  
PhD student



Tania Ramos  
Researcher @Tecnico

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