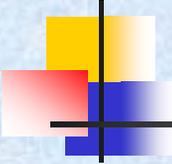


Enhancement to the Model System & Statistical Analysis



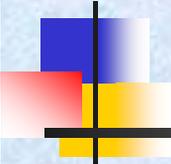
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Presentation Outline

1. Enhancements to the model system structure
2. Statistical analysis from the HIS





1. Enhancements to the Model System Structure



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Main Features

Activity-based approach:

- Daily pattern integrity
- In-home activity
- Intra-HH interactions

Tour-based approach:

- Chained trips
- Fragment of pattern

Micro-simulation approach:

- Fully disaggregate models
- List/agent-based structure
- "Crisp" choice instead of fractional probability

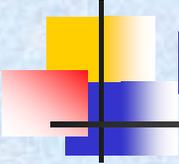




New Features

- Explicit modeling of intra-household interactions (horizontal integrity)
- Enhanced temporal resolution that makes explicit modeling of time use available (downward vertical integrity)
- Using log-sums or generated outcomes from the lower-level choices (upward vertical integrity)



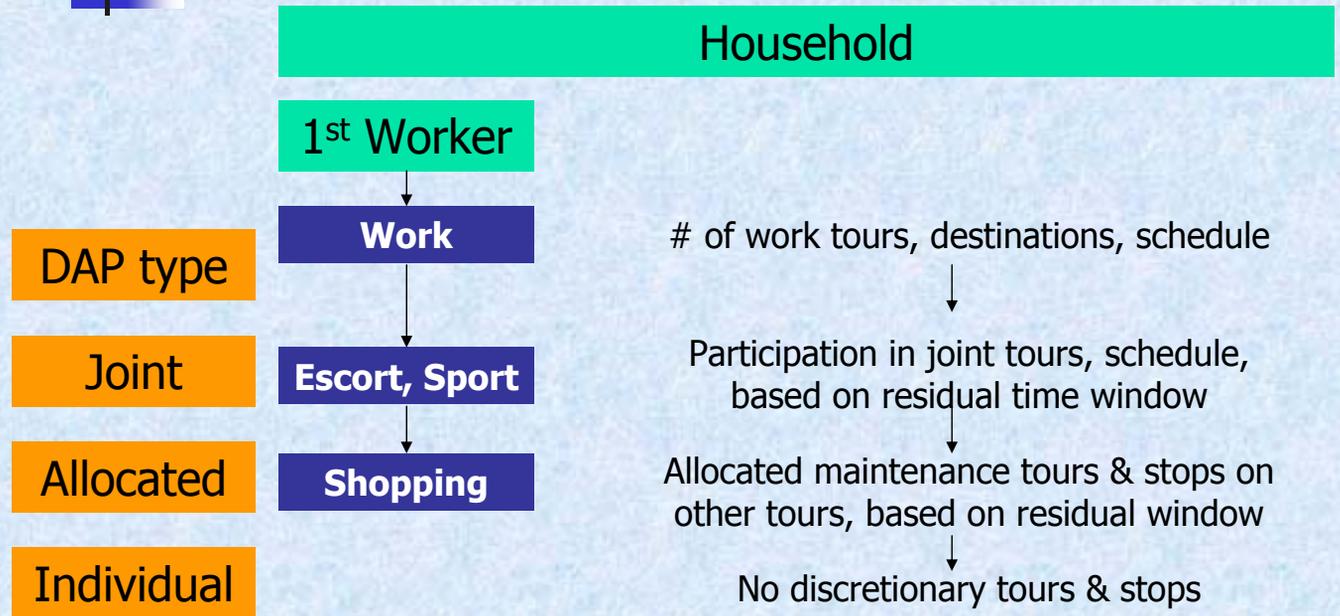
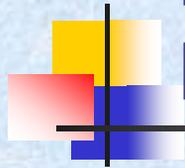


Household Activity Matrix

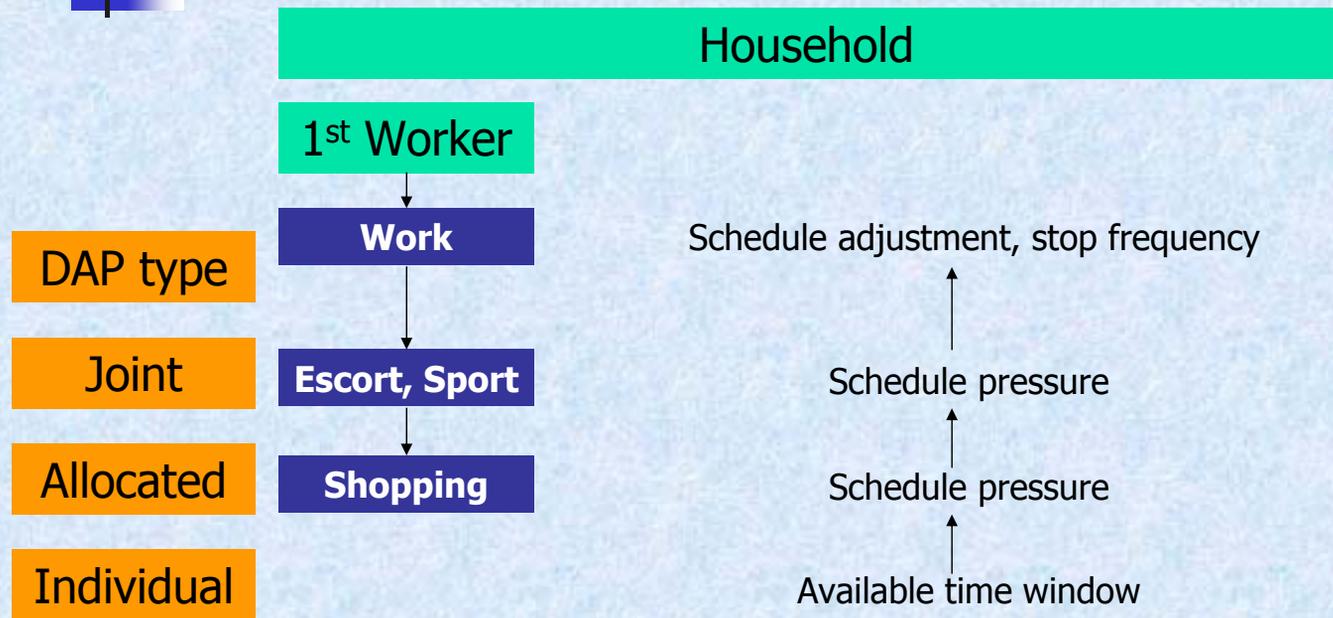
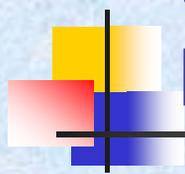
	Household			
	1 st Worker	2 nd Worker	School Ch	Preschool
DAP type	Work		School	
Joint		At home		At home
Allocated	Escort, Sport		Sport	
Individual	Shopping			Visit friend



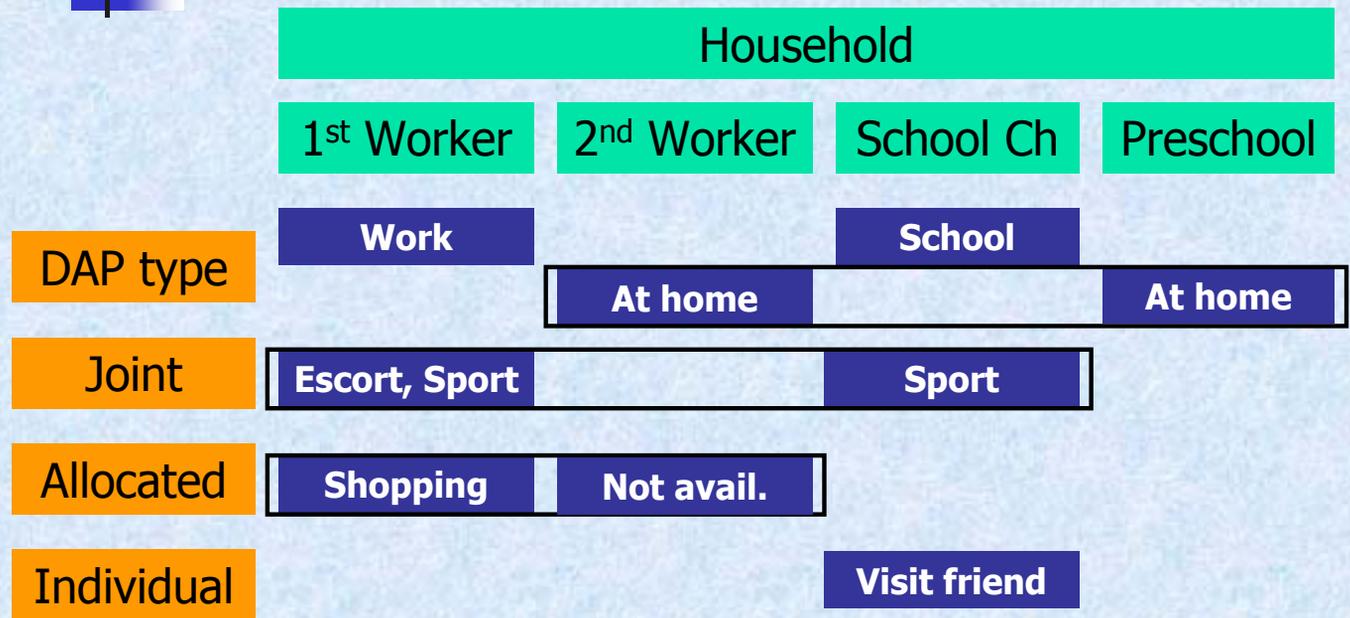
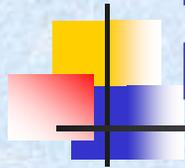
Downward Vertical Integrity of Person Pattern

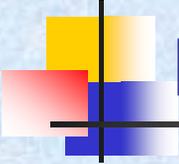


Upward Vertical Integrity of Person Pattern



Horizontal Integrity across Person Patterns

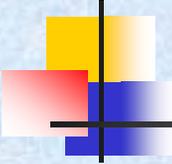




Back to 1st Worker

	Household			
	1 st Worker	2 nd Worker	School Ch	Preschool
DAP type	Work	At home	School	At home
Joint	Escort, Sport		Sport	
Allocated	Shopping			
Individual			Visit friend	

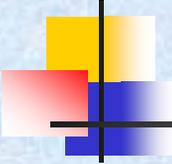




Intra-Household Interactions

- Entire-day level:
 - Staying at home / absent together (vacation, indoor family event, childcare)
 - Having non-mandatory travel pattern together (day-off for major shopping, outdoor family event)
- Episode level:
 - Shared activity / joint travel episodes
 - Allocation of maintenance activities
 - Car allocation





Explicit Time-Use Modeling

- Available only with enhanced temporal resolution (≤ 1 hour)
- Explicit tracking of available time windows and using these variables for activity generation and scheduling





Upward Vertical Integrity

- Conventional fractional-probability choice models use log-sums (expected utility) over the lower level choices
- This technique can be used for micro-simulation; however it is computationally intensive:
 - Mode-choice log-sums used in destination choice takes 50% of total running time
 - Full destination-choice log-sums required for DAP model (over all destinations, TOD periods, and modes) are not realistic
- The same way how “crisp” choice is micro-simulated out of fractional probabilities, the lower-level representative can be chosen for expected utility instead of log-sum
- In the overall iterative framework of the model application, generated outcomes from previous iterations can be effectively used; this way the evolution of the model outcomes can be interpreted as learning process.

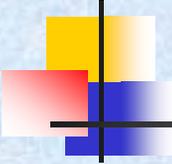




2. Statistical Analysis from HIS



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8 Person Types

- **Adult (18+):**
 - **Worker:**
 - Full-time (35+ hours a week)
 - Part-time (less than 35 hours a week)
 - **Non-worker:**
 - University/college student
 - Homemaker/unemployed U65
 - Retired 65+
- **Child (U18):**
 - Preschool (U6)
 - School pre-driving (6-15)
 - School driving (16-17)





Distribution by Person Type

Person type	Survey scope		Expanded regional	
	Persons	%	Persons	%
1-Full time worker	8,564	46.7%	1,463,013	40.8%
2-Part-time worker	1,064	5.8%	190,727	5.3%
3-University student	708	3.9%	118,242	3.3%
4-Non working and non-studying adult under age 65	2,348	12.8%	463,456	12.9%
5-Retirement age (age 65+)	1,668	9.1%	268,961	7.5%
6-Driving-age child 16-17	483	2.6%	115,762	3.2%
7-Pre-driving-age child 6-15	2,129	11.6%	601,071	16.8%
8-Preschool-age child (under 6)	1,362	7.4%	362,165	10.1%
Total	18,326	100.0%	3,583,398	100.0%



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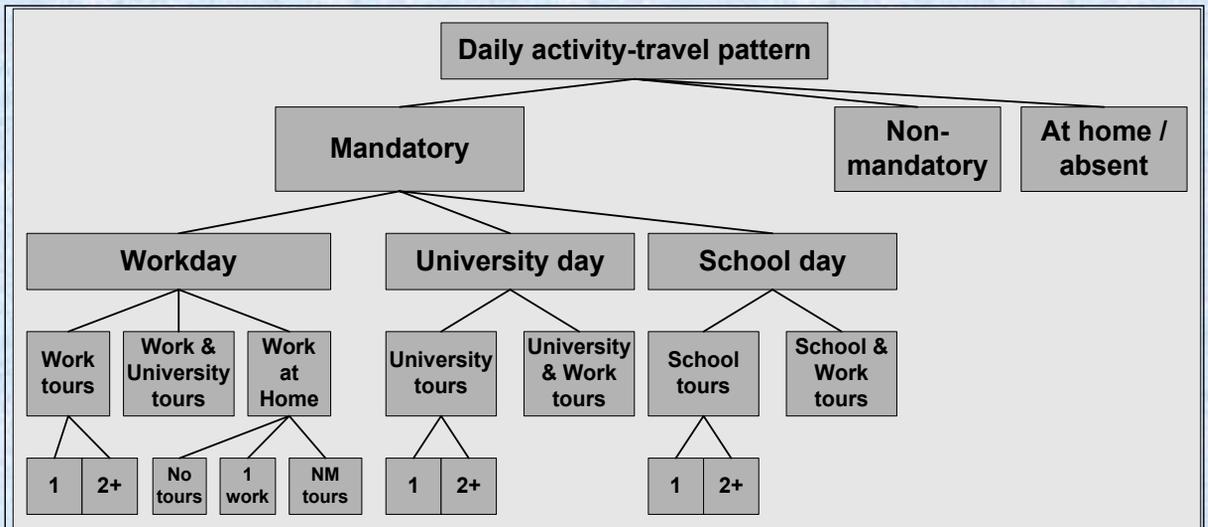


Distribution by Tour Purpose

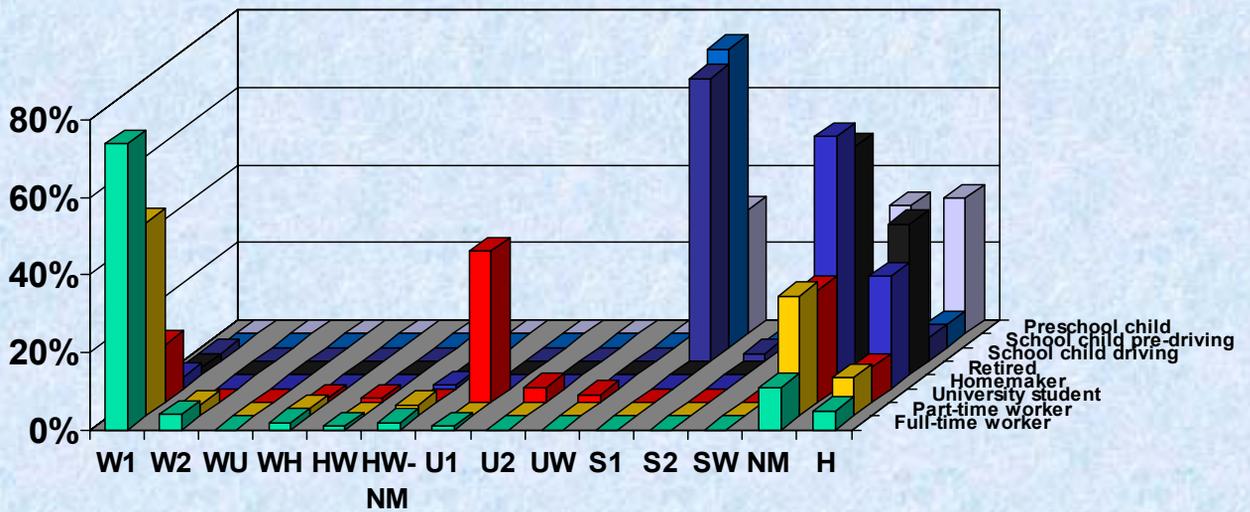
Purpose	Survey scope, 2 days		Expanded to one region-day	
	No of tours	%	No of tours	%
1-Work	14,009	38.3%	1,187,591	34.8%
2-University / College	774	2.1%	63,837	1.9%
3-School	3,878	10.6%	517,814	15.2%
4-Escorting	3,092	8.4%	329,754	9.7%
5-Shopping	4,086	11.2%	357,624	10.5%
6-Other maintenance	3,101	8.5%	284,420	8.3%
7-Eating out	2,453	6.7%	192,692	5.7%
8-Visiting relatives / friends	1,329	3.6%	116,797	3.4%
9-Other discretionary	3,902	10.7%	389,084	10.5%
Total	36,624	100.0%	3,409,613	100.0%



14 DAP Types



Observed DAP Type Frequency

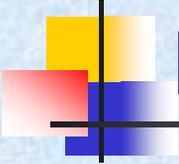




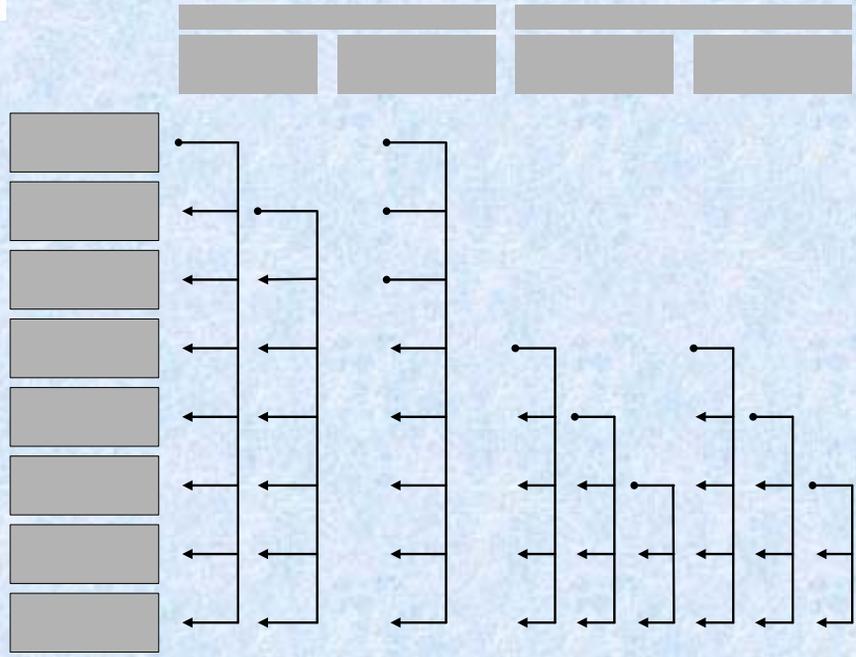
Intra-Household Order

- **(Children → Adults)** Adults take care on children rather than vice versa
- **(Preschool → Pre-driving → Driving)** Younger children require more care comparing to older children
- **(University → Full-time work → Part-time work → Non-work)** University students and full-time workers have less flexible schedules comparing to part-time workers and non-workers



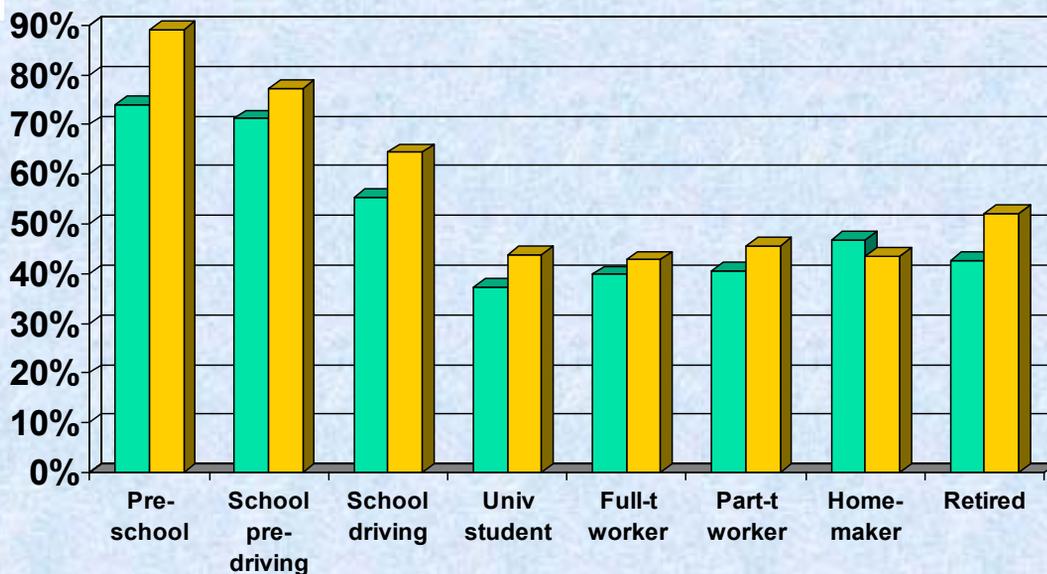


Linkage Across HH Members



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Summary of DAP Type Sharing

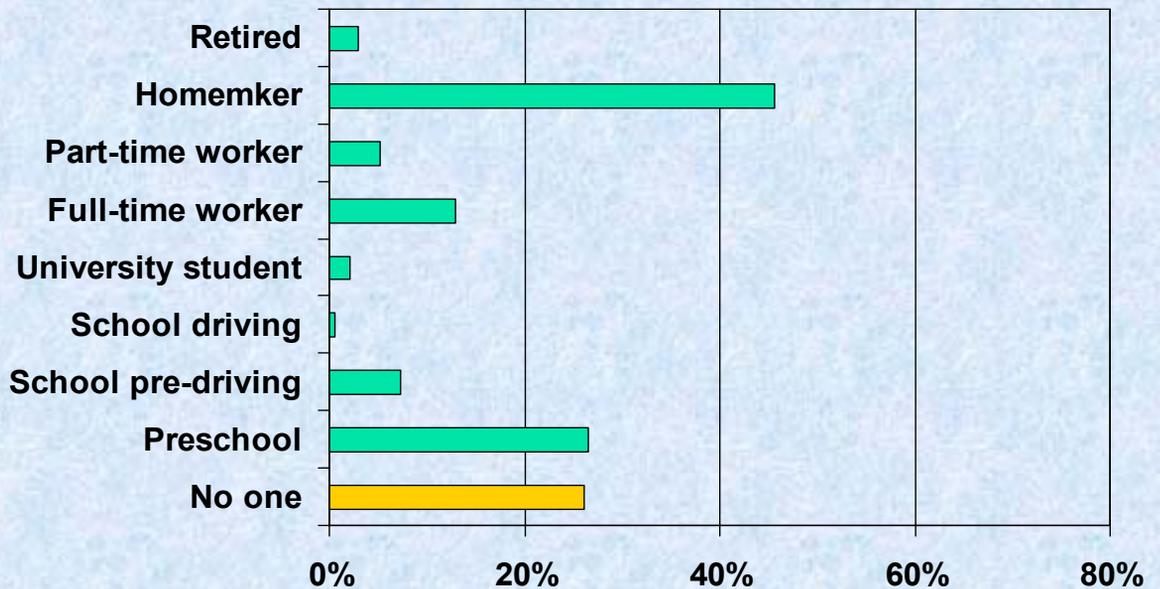


■ Shared stay at home ■ Shared non-mandatory travel day



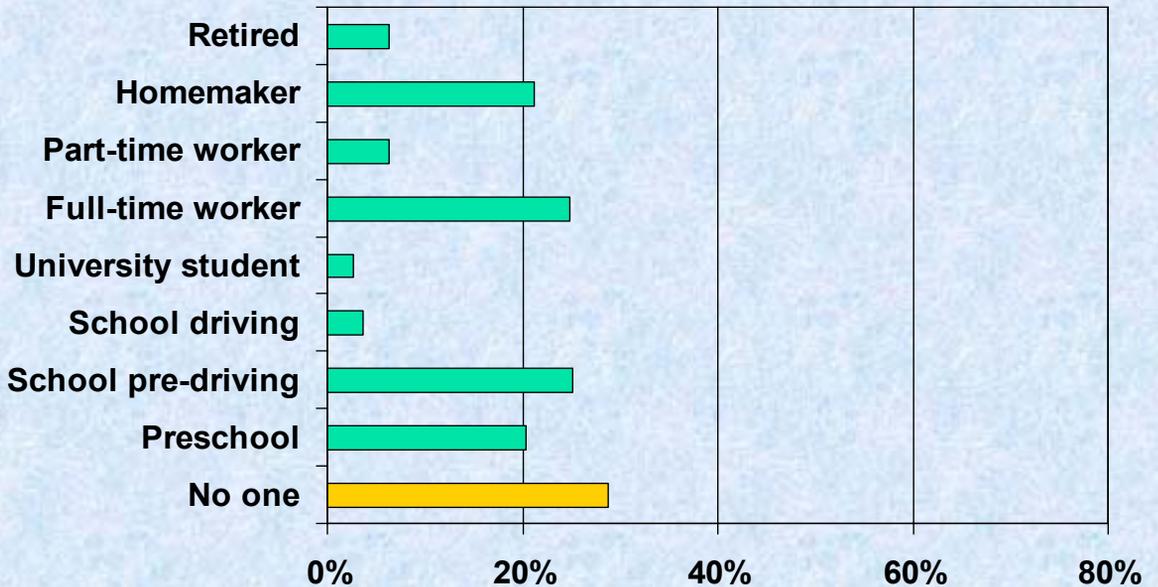
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Preschool Child Full Day at Home: Who Else Full Day at Home?



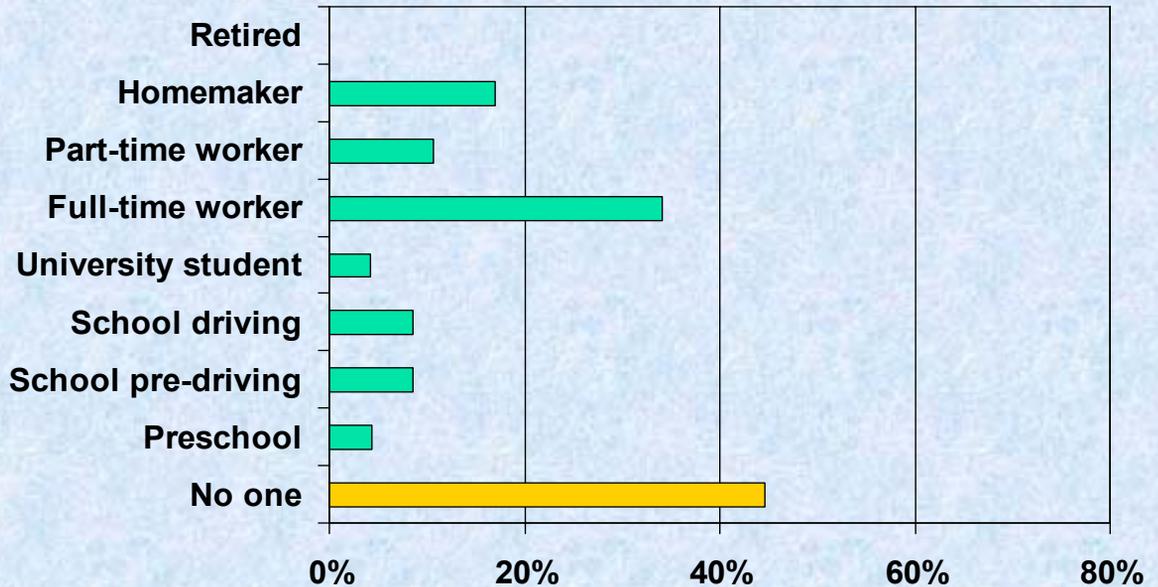
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School Pre-Driving Full Day at Home: Who Else Full Day at Home?



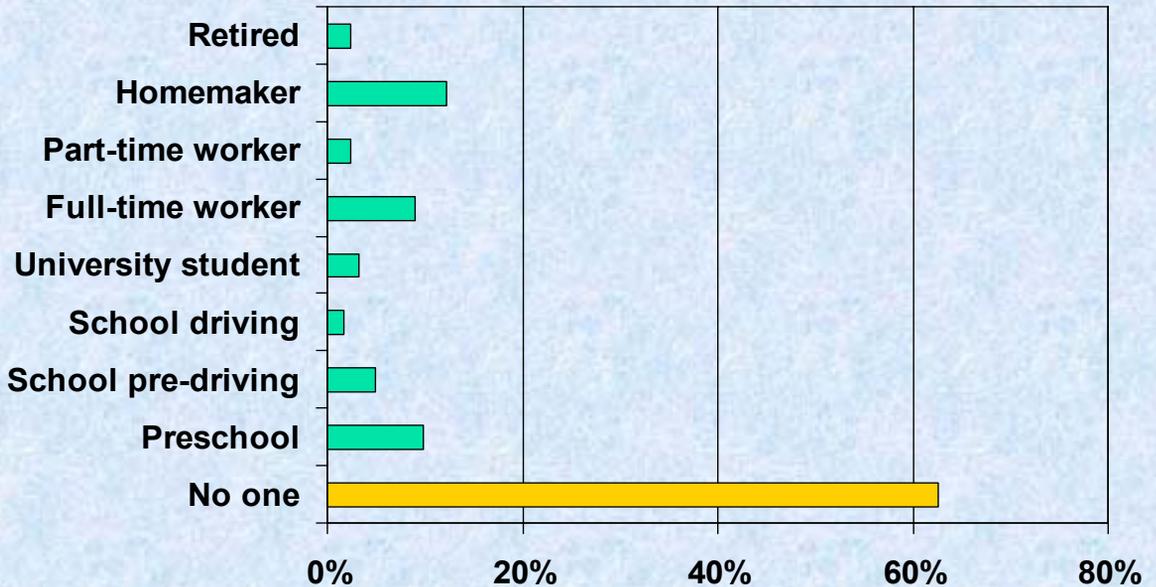
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School Driving Full Day at Home: Who Else Full Day at Home?

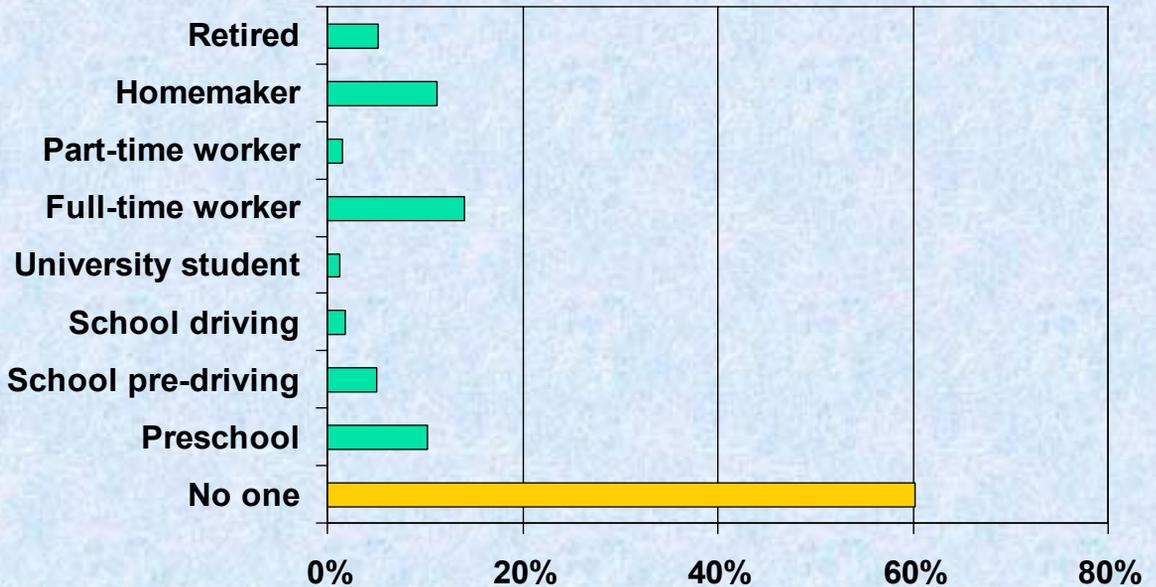


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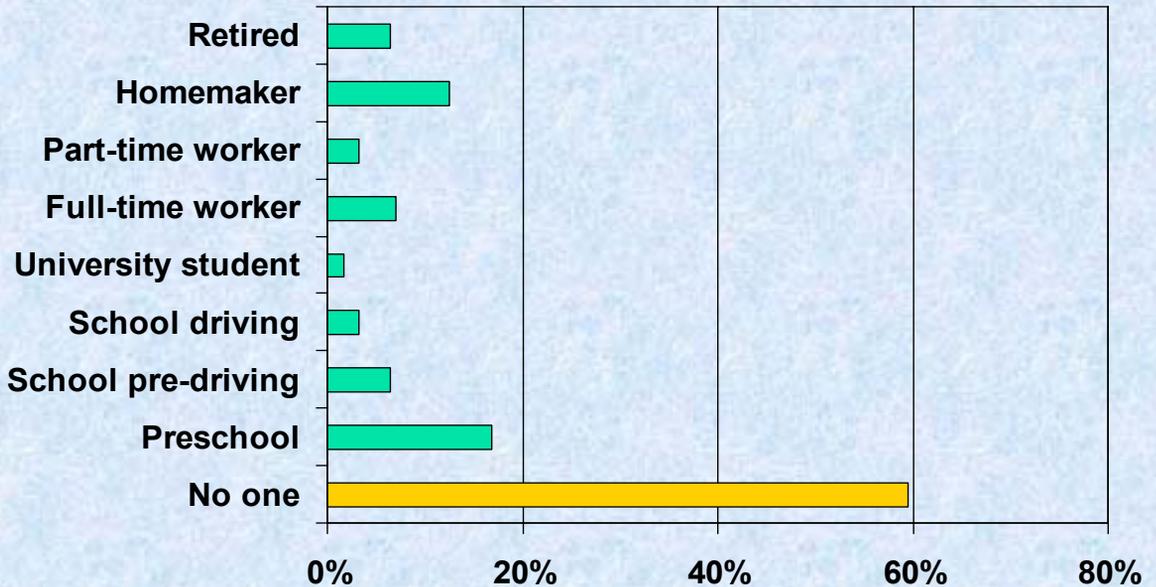
University Student Full Day at Home: Who Else Full Day at Home?



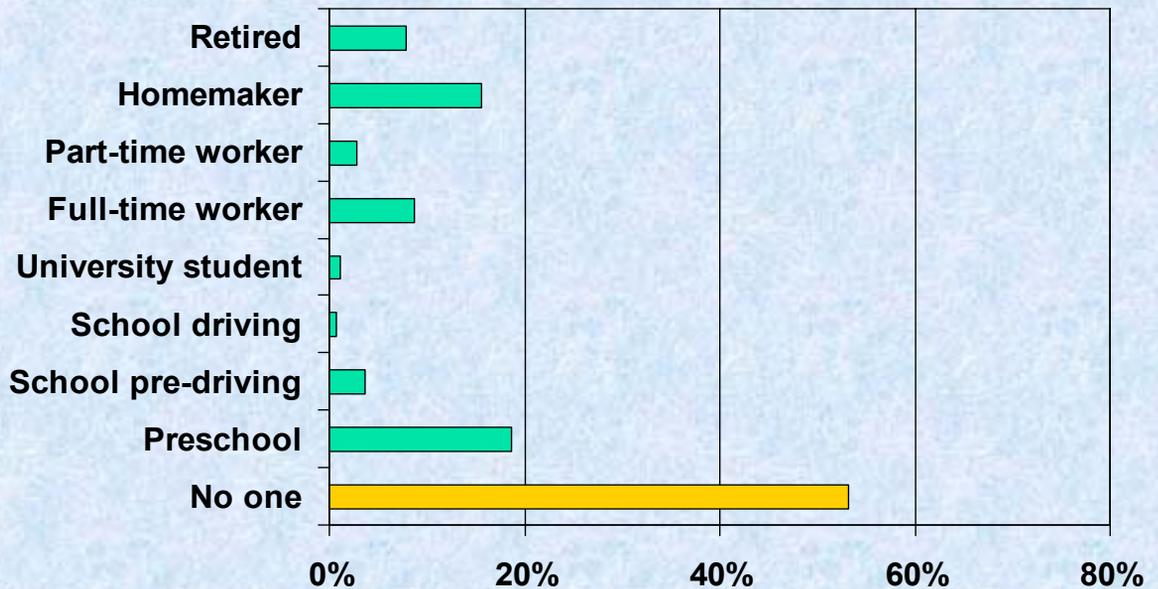
Full-Time Worker Full Day at Home: Who Else Full Day at Home?



Part-Time Worker Full Day at Home: Who Else Full Day at Home?



Non-Worker Full Day at Home: Who Else Full Day at Home?



Retired Full Day at Home: Who Else Full Day at Home?

