

NWIRP Research Study of Hurricane Maria (Puerto Rico)

Recovery of Social Functions Project

Project Leader: Maria Dillard

Objective: To examine the recovery trajectories of sampled schools and hospitals in order to identify characteristics and conditions associated with recovery of critical social functions from Hurricane Maria in Puerto Rico.

Background & Motivation

- The NIST Hurricane Maria Program[^] includes a project focused on the recovery of education and healthcare services associated with critical buildings (schools and hospitals) in Puerto Rico.
- Both education and healthcare services are an important part of understanding the impacts of Hurricane Maria, as well as the long term recovery of Puerto Rico.
- This project will be used to support the development of a methodology to assess community-scale resilience.
- The focus is on empirical relationships between social functions and physical systems with an aim to identify predictors of recovery outcomes.
- The project relies on a foundational understanding of social functions and buildings and infrastructure systems as linked.*

[^]Under the NIST Hurricane Maria Program, NIST is conducting a NCST investigation and a NWIRP study.

*NIST SP 1190 2016. <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v1.pdf>

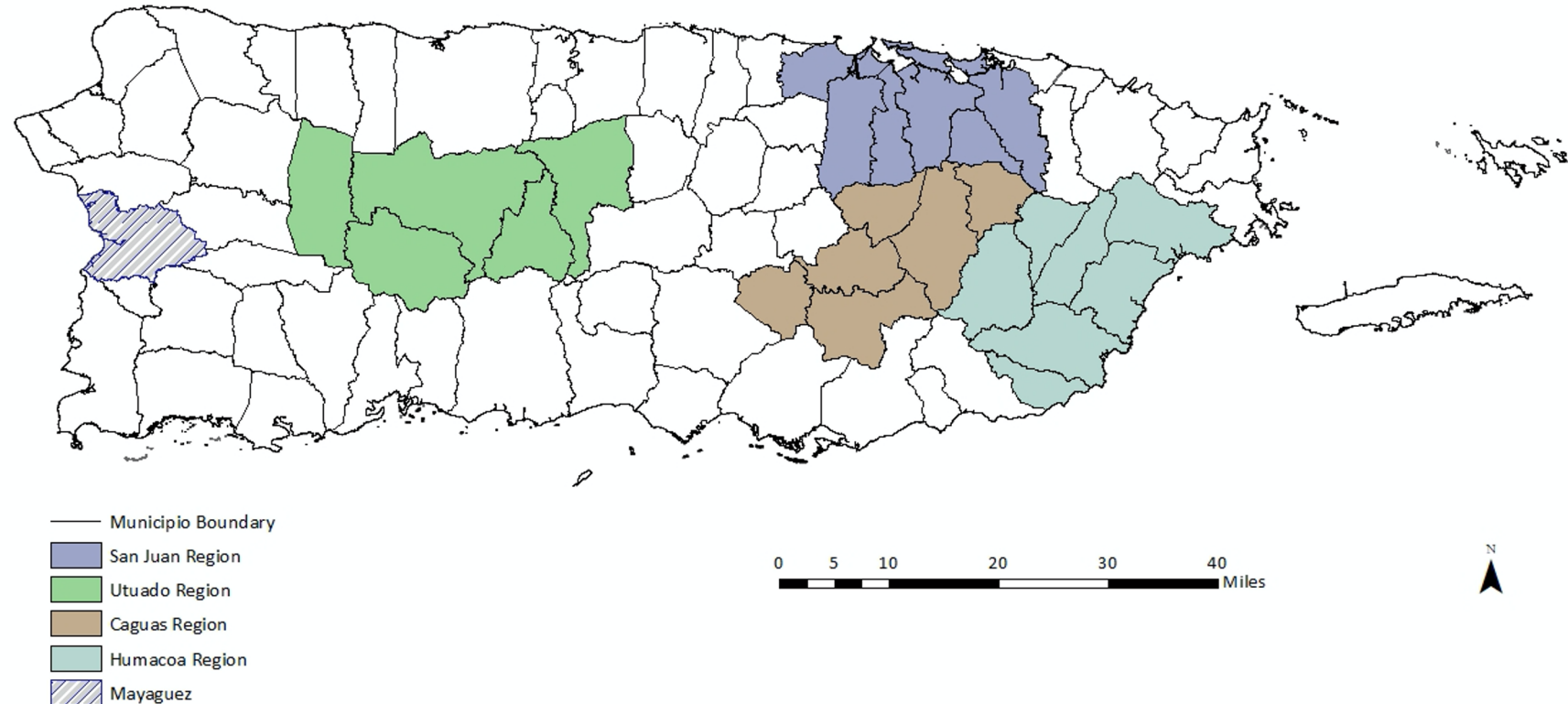
All photos credited to NIST.



Background: Study Areas

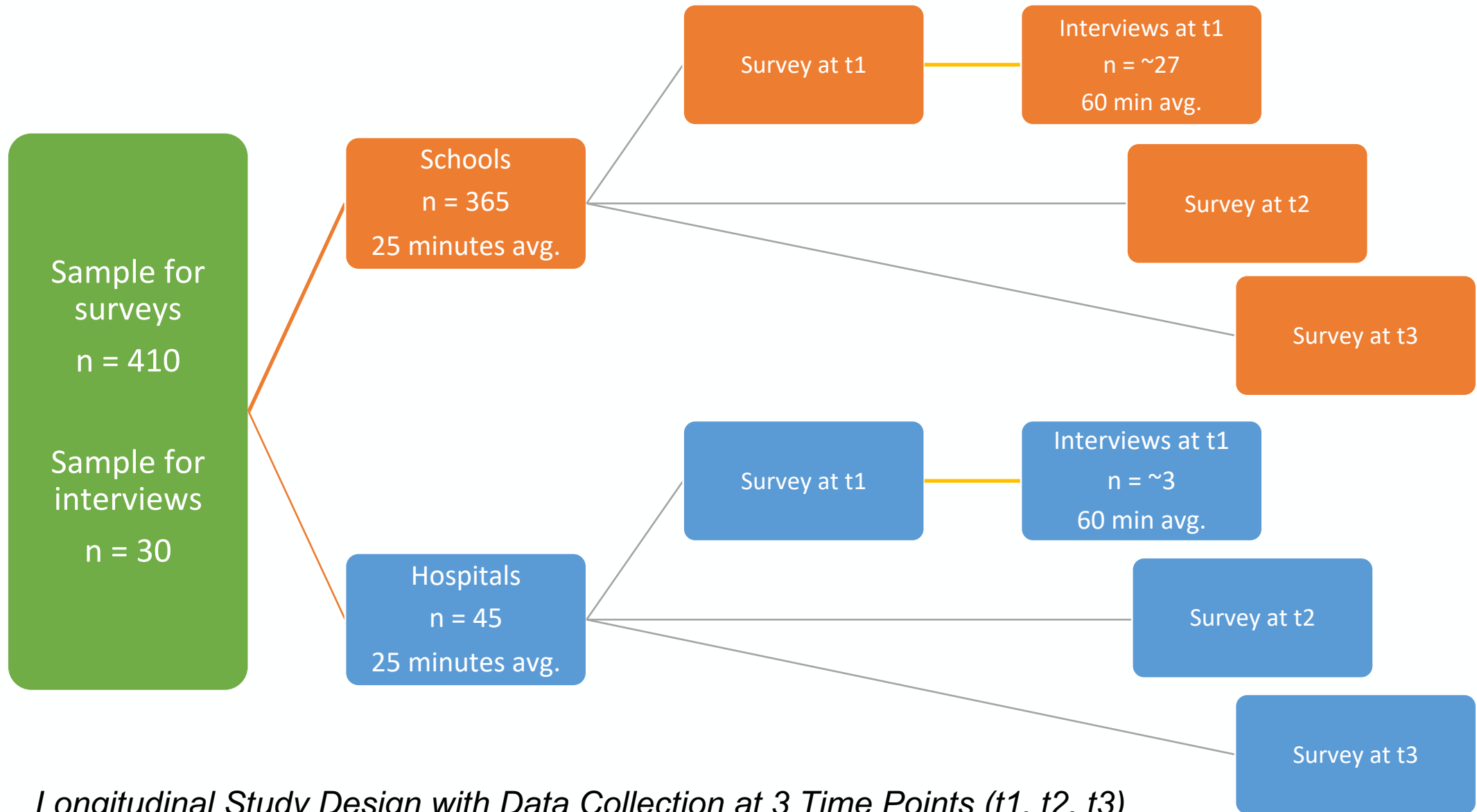
- Includes 4 regions common across all NIST Hurricane Maria Program projects:
 - San Juan Region
 - Utuado Region
 - Caguas Region
 - Humacao Region
- Additionally, includes the municipio of Mayagüez where Hospital Bella Vista is located

Study Areas for NIST Hurricane Maria Program



Data Source: US Census Bureau TIGER/Line 2016, FEMA 2017
Developed: NIST 2020; using ESR I software
Coordinate System: GCS NAD 1983
Datum: NAD 1983
Scale: 1:700,000

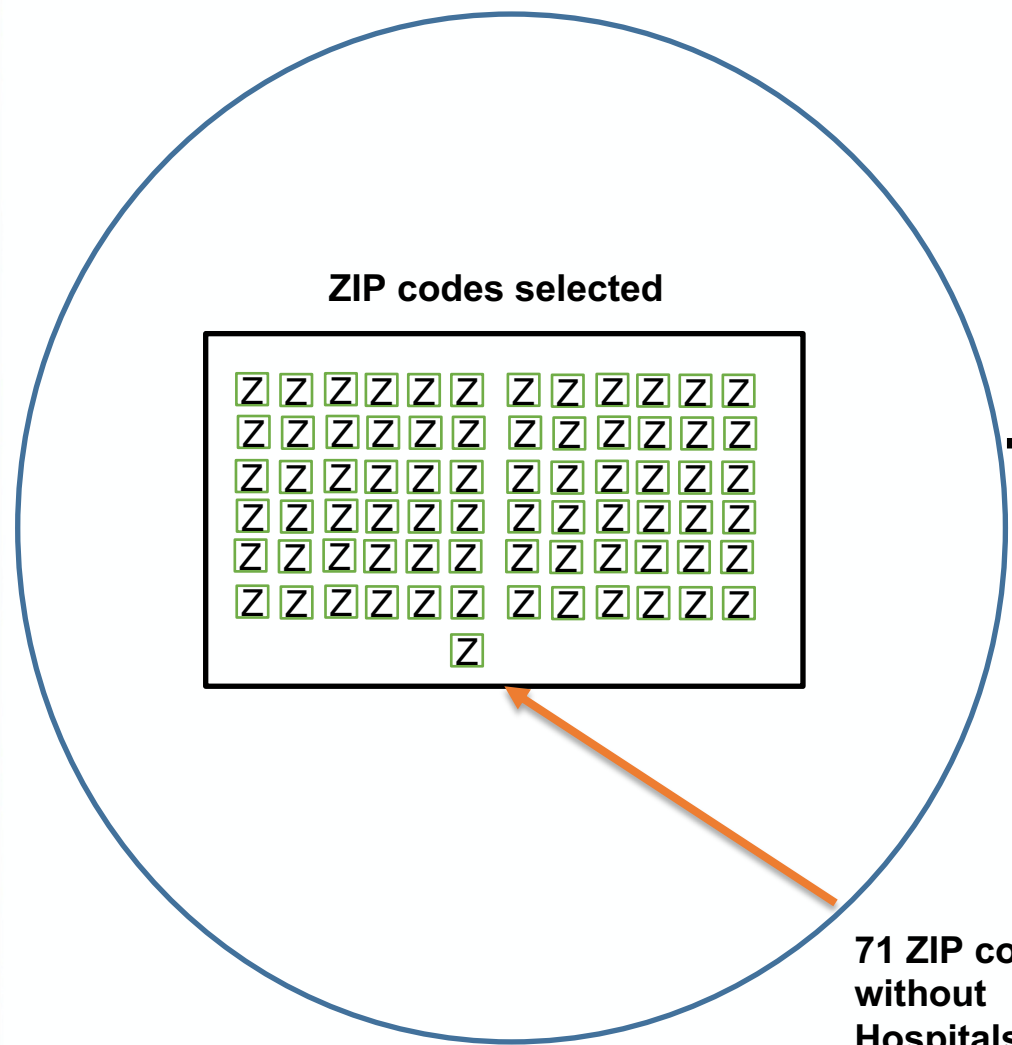
Project Plans: Study Design



Longitudinal Study Design with Data Collection at 3 Time Points (t1, t2, t3)

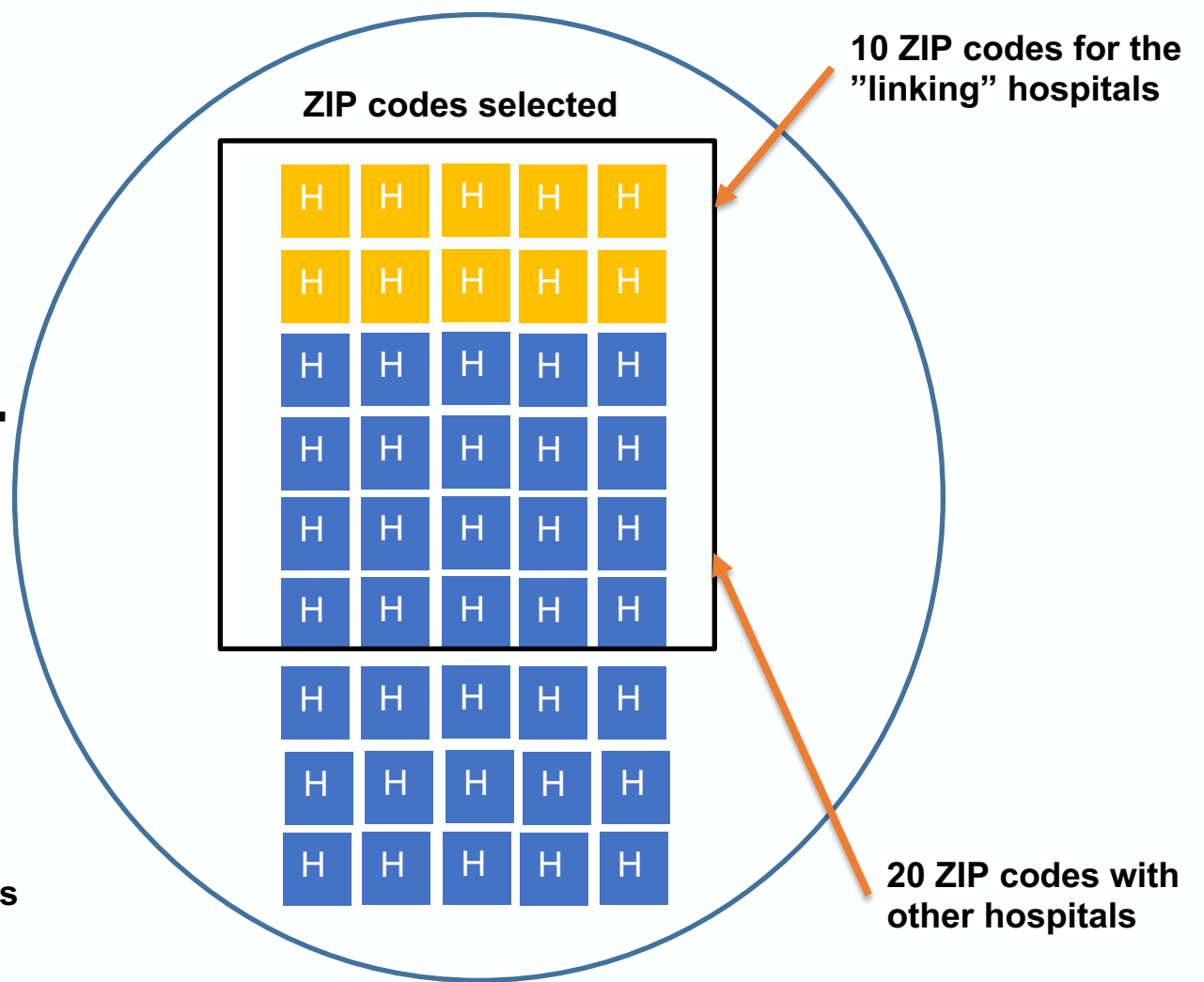
Project Plans: Sample Design

ZIP codes without hospitals



+

ZIP codes with hospitals



Recent Progress 1/4

NWIRP Recovery Projects Sample Distribution

	<i>Sampling unit</i>	<i>Proportion of total sample in each category</i>				
	ZIP Code Areas	“Linking” Hospitals	Other Hospitals	Schools	Manufacturing	Retail and Services
“Linking” Hospitals	10	100%	26%	23%	21%	20%
Other Hospitals	20		74%	25%	22%	29%
Non-Hospital	73			53%	58%	51%

Recent Progress 2/4

- Monthly and task specific meetings with survey and interview research services contractor since March 2020
- Executed change of data collection modes due to COVID-19



- Obtained required approvals for pilot tests and Wave 1 survey
 - NIST’s Institutional Review Board (Dec 2020); PR Department of Education (March 2021)
- Pilot test (1) for hospital survey complete (Feb 2021)
- Substantial revisions to both hospital and school surveys following pilot test (1)
 - Reduced length
 - Reduced cognitive burden – e.g., minimized comparisons across time
- Pilot test (2) for school survey in progress
 - Self-administered and interviewer versions of school survey programmed (April 2021)
 - Pilot training with data collectors (May 2021)

Recent Progress 3/4

Example of pilot test results for hospitals:

Recovery Progress	1 year after HM	2 years after HM (before COVID)
Recovery of service	Mean (Standard Deviation)	Mean (Standard Deviation)
Percentage of clinical services restored	90% (22% SD)	98% (14% SD)
Percentage of transportation services restored	50% (50% SD)	50% (50% SD)
Percentage of support services restored	95% (11% SD)	98% (4% SD)
Percentage of community services restored	63% (45% SD)	63% (45% SD)
Recovery of physical structure	Mean (Standard Deviation)	Mean (Standard Deviation)
Percentage of repairs of the physical structure complete	97% (4% SD)	100% (0% SD)



Temporary hospital facilities in Puerto Rico



A school in Puerto Rico

Notes: *Results of pilot test only; n = 6*
All photos credited to NIST.

Recent Progress 4/4

Current Survey Sections:

- Services and resources before and after Hurricane Maria
- Damage and disruption caused by the hurricane, such as those pertaining to buildings, utilities, and transportation
- Non-physical damage, such as employee well-being
- Repair and recovery process from the hurricane, including insurance and financial recovery assistance
- Actions the [school/hospital] is taking to prepare for future events

Current Time Periods:



Next Steps

- Analyze pilot data and make final survey revisions
- Obtain remaining approvals for Wave 1 survey and interview
 - Office of Management and Budget's Paperwork Reduction Act
- Launch full survey and interview data collection for Wave 1
- Develop Wave 2 survey



All photos credited to NIST.

Hospitals in Puerto Rico

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Project Leader: Maria Dillard

Project Team: Jarrod Loerzel (NIST), Kelly Jean Anderson (PREP
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Questions?

 **Please 'raise your hand' using the Blue Jeans
Participant window and unmute your audio and
video**