

**Integrating Objective Health Measures:
Using a Consumer Actigraphy Wristband to Supplement
a Survey of Caregivers and Teens**

Elyzabeth Gaumer,¹ Daniel Goldstein,¹ Caitlin R. Waickman,¹ Jack B. R. Jerome,¹
Jeanne Brooks-Gunn²

¹ New York City Department of Housing Preservation and Development, 100 Gold Street, New York, NY 10038; ² Teachers College, Columbia University, 525 West 120th Street, New York, NY 10027. The views expressed here are those of the authors and do not necessarily reflect those of the Department of Housing Preservation and Development or the City of New York.

Abstract

Many large-scale social surveys incorporate objective measures, such as biomarkers, anthropometrics, or actigraphy, to supplement self-reported information and ensure more valid measurements. We discuss the use of a consumer actigraphy wristband to augment data collection for the New York City Housing and Neighborhood Study (NYCHANS), a randomized control trial that evaluates the impact of affordable housing on the health and well-being of low-income New Yorkers. A subset of caregivers and teens were asked to wear the device for a week to collect objective measures of physical activity and sleep. We discuss implementation of this module, including consent/assent, incentive structure, and procedures used by the field team at the beginning and end of data collection. We also review some of the challenges faced and how they were addressed, such as selection of the appropriate device, navigating legal constraints of using such a device for research purposes, and confidentiality. This report on the use of a consumer actigraphy device as part of a survey of caregivers and teens advances knowledge of how to best capture such data without undue cost to the project or burden to respondents.

Keywords: wearables, actigraphy, objective health measures, physical activity

1. Introduction

Actigraphy data have the potential to capture a variety of physical activity and sleep measures more completely and accurately than would otherwise be possible through self-report in an interview. Continuous measures of steps taken, average sleep duration over a fixed period, and variation in the timing of sleep onset and awakening provide granular measurements that may reveal small treatment effects that could not be measured through standard survey items. Actigraphy data may also be collapsed and categorized based on clear and consistent thresholds to create more valid measures, such as the intensity and duration of activity based on Metabolic Equivalent of Tasks (METs) rather than respondent's own understanding and recall of vigorous, moderate, or light activities. This type of data supports novel analyses, such as caregiver-youth dyads, where precise consistency of data collection across research subjects is necessary but difficult to collect given variation in surveys targeted to adults versus children, and comparisons of self-report and objective measures. Perhaps most important, when such data are collected through consumer activity trackers, they can provide a low-cost solution to data collection with minimal respondent burden.

As response rates continue to decline and data demands increase, it is important to consider ways to supplement standard survey research with secondary data collection procedures that are less taxing for participants and increase data availability and quality. Supplementing standard interview procedures with passive data collection, such as wearables, is one potential strategy for gathering information on physical activity and sleep that can record more granular and valid measurements than self-report alone. This type of supplement can add tremendous value to the research agenda; however, there are substantial costs in terms of procedural complexity, interviewer training, consent, cooperation rates, and the demands of processing large datasets, among others.

In this paper, we discuss the actigraphy supplement that was implemented as part of the New York City Housing and Neighborhood Study (NYCHANS), a randomized control trial that evaluates the impact of affordable housing on the health and well-being of low-income households. In the sections that follow, we provide background information on NYCHANS, key decisions that were made regarding the design of the actigraphy supplement, details on the field procedures used to achieve high consent and assent rates, and an overview of the data structure and quality of the data received.

2. Background

2.1 The NYC Housing and Neighborhood Study

The New York City Housing and Neighborhood Study (NYCHANS) is a natural experiment to evaluate the impact of affordable housing on the health and well-being of recipient households. It leverages the existing housing lottery system used by the City of New York to identify two groups: those that were offered an affordable housing unit (“treatment”) and those that were eligible for those same units but not offered housing because demand exceeds supply (“control”).

NYCHANS follows treatment and control households that applied to live in one of thirteen affordable housing developments (“study sites”) located in six neighborhoods in Manhattan, Brooklyn, and The Bronx. The study sites are newly constructed developments built between 2011 and 2015. NYCHANS includes a total of 900 low-income affordable units¹ ranging in size from studios to three-bedrooms; income eligibility ranges from 40 to 80 percent of HUD Income Limits.² Each study site held its own lottery following standard City guidelines for its marketing and lease-up process. All study participants lived in New York City at the time they applied for affordable housing.

Follow-up interviews were conducted approximately three to five years after group assignment to evaluate various household- and individual-level outcomes of interest. Major areas of focus included housing costs and quality, neighborhood conditions and safety, social networks and neighboring behavior, financial stability, developmental and

¹ This is the number of units included in the study and does not represent the total number of residential units in these developments. Some developments also include higher-income affordable units and/or market-rate units that were beyond the scope of NYCHANS. In some instances, only a subset of the low-income affordable units was included in the study; this was done to balance the distribution of unit types within and across study sites.

² In Fiscal Year 2020, this is equivalent to between \$37,560 and \$75,120 for a family of three; however, a household with a voucher may earn less than the minimum income to qualify for a unit. Actual income eligibility criteria were determined based on the year of the housing lottery for that development.

educational outcomes for children, mental health, physical health, and health behaviors. Objective health measures were collected for a subset of caregivers and children; these same households were recruited for the actigraphy supplement.

2.2 Follow-Up Interviews

The structure and content of the follow-up interview varied depending on household composition. One adult from each household that did not apply to live with a child was recruited to participate in a 60-minute interview (“Householder Interview”). For treatment and control households that applied to live with one or more child, NYCHANS recruited a primary caregiver for a 90-minute face-to-face interview (“Caregiver Interview”).

The Caregiver Interview included the same content as the Household Interview plus additional questions about parenting, information about each child, and detailed information on one child specifically (the “Focal Child”). To reduce time, caregivers were randomly assigned to one of two paths; each path contained a subset of questions from the Householder Interview that were divided between the two paths. Questions about caregiving, children, and family life were asked of all caregivers, regardless of path. For each participating family, NYCHANS also recruited up to two children ages eight to eighteen per household³ for face-to-face interviews. Children ages eight to thirteen were asked to participate in a 30-minute interview (“Child Interview”); teens ages thirteen to eighteen were asked to participate in a 45-minute interview (“Teen Interview”).

The actigraphy module gathered key information on physical activity and sleep, which supplemented self-report information on health and health behaviors that was obtained during the interview. Caregivers were asked about diet, smoking and alcohol consumption, overall activity level, and a battery of questions designed to measure vigorous, moderate, and light physical activity. They were also asked to complete the Patient Health Questionnaire – 2-item (PHQ-2) to measure depression, the Generalized Anxiety Disorder – 2-item (GAD-2), and the Pittsburgh Sleep Quality Index (PSQI). Teens were asked about diet, overall physical activity level, and risky behaviors, including smoking and alcohol consumption. Caregivers were asked to complete select modules of the Child Behavior Checklist (CBCL), which gathered information on internalizing and externalizing behaviors of the Focal Child. Body Mass Index (BMI) was calculated for caregivers, teens, and children who had their measurements taken during the interview.

NYCHANS sought to conduct all family interviews (caregiver as well as child/teen interviews) during a single appointment at the project’s offices in lower Manhattan.⁴ As part of the interviews, all adult and child participants had their height and weight measured. Caregivers also had their blood pressure measured. Both caregivers and teens

³ Only children that were listed on the original application were eligible to participate. For households with more than two children, NYCHANS gave priority to the oldest child. In cases where the household’s oldest children were triplets, participants were selected based on order of birth beginning with the first born.

⁴ Caregivers that were unable to complete the full 90-minute interview were offered a short-form version of the questionnaire that captured key outcomes only. The short-form interview took about 25-minutes to complete and was administered as a computer-assisted self-interview (CASI) using a tablet interface. This could be completed at any location, but primarily was administered at the respondent’s home. In these cases, children were considered ineligible to be interviewed.

were recruited for the interviews as well as the actigraphy supplement during this office appointment.

Data collection was conducted by researchers at the NYC Department of Housing Preservation and Development and all protocols were approved by the Teachers College Institutional Review Board. All interviews were offered in English, Spanish, Mandarin, Polish, and Russian.⁵ The overall interview response rate was 71.5 percent (71.6 percent for treatment; 71.1 percent for controls). In total, 496 out of 628 caregivers completed an interview at the office and were therefore eligible for the actigraphy supplement; these 496 families included 208 teens that were also eligible for this component of the study.

2.3 The Actigraphy Supplement

Each caregiver and teen participant was asked to wear a consumer actigraphy device for a period of seven days immediately following their interview. Each adult and teen was fitted for a wristband and was given the option of choosing from one of ten colors. A follow-up appointment was made for about a week later when the participants would return to the project's offices so that the device could be synced to retrieve data and incentives could be distributed.

Overall, 91 percent of eligible caregivers and teens consented or assented to participate in the actigraphy supplement (n=641). Of those, 98 percent returned the device (n=630) and 96 percent had at least some data recorded and retrieved (n=618). 92 percent (n=592) met the standards for inclusion in the physical activity analytic dataset, and 78 percent (n=502) met the standards for inclusion in the sleep analytic dataset.

3. Practical Considerations

Passive data collection through a wearable device can add value to a large survey effort by expanding the types and amount of data collected, reducing respondent burden, and facilitating analyses not possible through self-report alone. But, augmenting a survey effort with a secondary data collection effort also increases the complexity of the study design and protocols, adds cost per case to an already expensive enterprise, and requires additional protections to ensure privacy and confidentiality.

In some cases, the broader needs of NYCHANS guided implementation of the supplement; for others, the practical reality necessitated certain decisions regarding study design. In this section, we discuss some of the challenges faced and how they were addressed for the NYCHANS actigraphy module.

3.1 Selection of the Wearable Device

There is a wide variety of actigraphy devices available, including both consumer models and those developed specifically for research use. Each has advantages and shortcomings. For many large-scale social surveys, the value of adding an actigraphy module is to supplement the self-report data with a limited set of information on physical activity and sleep with minimal cost and respondent burden. For NYCHANS specifically, the priorities for selecting the device were ensuring compliance and ease of implementation. For these reasons, the project only considered lower-priced consumer wearables and did

⁵ Caregiver interviews were only completed in English and Spanish; householder interviews for those without any co-resident children were completed in English, Spanish, Mandarin, Polish, and Russian.

not pursue more precise research devices that collected a wider range of data (such as heart rate or vertical climb) or non-wearable devices such as an actigraphy app on a smartphone. After considering and testing several models, NYCHANS selected the Fitbit® Flex (hereafter referred to as Fitbit®) for the reasons discussed below.

3.1.1 Battery Life

Battery life is one important lever that affects whether the device will be worn (or carried) as well as the continuity of data collected. Short battery life may lead to periods when the device either cannot collect data at all (due to drained battery and/or during charging) or lead to lower compliance because respondents forget to carry the device after charging. The need to monitor battery life may also increase awareness that the device is gathering data, altering the respondent's behavior.

At the time that NYCHANS was developing the study, Fitbit® offered a longer battery life (about a week) than many other consumer devices on the market, reducing the need for participants to charge the device during the field period. Tests of the average length of a single charge were used to determine the seven-day field period used in NYCHANS. Respondents were instructed that no charging was necessary and that they should continue to wear the device throughout the field period, removing it only when bathing or swimming. For this reason, NYCHANS did not provide any charging cords to participants, which had the added benefit of reducing the amount of equipment and training given to participants. Respondents were instructed to continue wearing the device until they returned for the follow-up appointment, even if they believed the battery had been depleted.

3.1.2 How Data are Stored and Synced

The same compliance issues posed by the need to *charge* a device apply to the need to *download* or *sync* data on a regular basis during the field period. For this reason, it was important to consider how much data can be stored on the device itself between downloads. It is worth noting that this is not always the same length of time as battery life; some devices can hold many days of data beyond when the battery is expected to last and vice versa.

Any requirement for participants to download data during the field period presents additional challenges as well. In some cases, device-specific equipment is necessary (e.g., a cord and/or dock); in other cases, participants would be required to have access to additional resources that the research project may or may not be able to provide (e.g., wireless or blue-tooth connectivity as well as a device to receive the download such as a smartphone or tablet). These factors could add to the cost and complexity of the research protocol. Syncing also drains battery life, reducing the amount of time a respondent can wear the device without charging.

Nearly all consumer actigraphy devices allow users to sync their data to an application that provides robust reporting that can be viewed on a smartphone, tablet, and/or website. This means that any device that requires a participant to download the data may also be facilitating regular viewing of the data that are being collected, potentially altering the behavior that the research is seeking to measure.

The NYCHANS team's selection of Fitbit® addressed some of these issues; other workarounds were achieved through the protocol. First, Fitbit® enabled about a week of data to be stored directly on the device, eliminating the need for participants to sync their

data during the field period. Although there was no *need* to sync the data, some users may still *want* to download and view their progress. This secondary challenge was addressed through the consent/assent process and the protocol. The device was set up in advance of the interview appointment and linked to a project-specific email account and password. This information was not given to participants and they were instructed not to attach the device to an alternative (personal) email account. The consent and assent process included details whereby the participant agreed not to sync or view the data through another email account. It was also made clear that any deactivation from the project account would disqualify the individual from receiving the incentive at the end of the field period.

3.1.3 *Blinding the Device*

One related, but distinct, factor is whether participants can see any information collected on the device itself—that is, whether the device is blinded. Consumer devices are designed specifically to enable customers to quickly and easily view progress toward their goals throughout the day and many include features that enable a wearer to see progress directly from the device, either in the form of a mini-dashboard or other monitoring feature. As with participants downloading their data and viewing progress on an app, the ability to view details on the device may lead to altered behaviors that invalidate the study aims.

Fitbit® had only minimal reporting on the device itself—a number of small lights that appeared on the wristband that marked progress toward one’s step goal when the device was tapped. By setting the goals at a standardized high level⁶ for every participant, NYCHANS effectively rendered these progress lights meaningless. This was an advantage of selecting an earlier generation of device, as more recent models provide the wearer with more detail on the device.

3.1.4 *Other Benefits*

Fitbit® provided other advantages, beyond long battery life, storage capacity, and the ability to practically blind the device. First, the wristband and device are separate, which enabled NYCHANS to provide a new wristband for each participant, while being able to reuse the device as needed. This helped with cost controls, as the device is much more expensive than the wristband. The ability to purchase wristbands separately also enabled the research team to offer the choice of color to participants—a detail that made participation fun, particularly for younger participants. In some cases, siblings who were too young to participate were given a wristband without a device so that they could feel included. The ability to do so without violating our terms of use was a valuable benefit that furthered rapport with the participating family.

Fitbit® offered both small and large wristband sizes, which enabled the research team to accommodate the vast majority of participants. An extra-large size was also available, though only in a single color; this was a critical factor in ensuring that all participants were able to contribute and not feel excluded as a result of body type.

Over the time period when NYCHANS was developing its actigraphy supplement and into the launch of fieldwork, Fitbit® grew substantially in its market share. During the study period, the parent company went public and greatly expanded its advertising and name-recognition. Many of the participants knew what the device was, how it worked,

⁶ Progress goals were set to 100,000 steps per day on every account/device.

and had a high comfort level as a result of seeing others around them wearing similar devices.

3.2 Legal Matters

Use of a consumer actigraphy device represents unique challenges with regard to legal terms of use as well as the protection of human subjects and assurance of confidentiality. For NYCHANS, several steps were taken to address these issues.

NYCHANS had originally intended to collect actigraphy data for all caregivers and children that participated in the Caregiver, Child, and Teen Interviews. This would include children ages eight and older. The Children's Online Privacy Protection Act of 1998 (COPPA) governs online accounts that collect personal information from children under age thirteen. While younger children may use accounts with permission of the parent or legal guardian, some websites (including Fitbit[®] at the time the actigraphy module was fielded) declined to allow younger users⁷. NYCHANS therefore altered its original scope to only recruit teens age thirteen or older.

Consumer devices have standard terms of use that often come in conflict with research protocols and procedures. For example, standard user agreements often preclude redistribution to a third party, limit the ability to create user accounts, and provide access to some or all data collected on the device by the developer, including the identity of the user. The NYCHANS team negotiated supplemental terms of use for the purposes of the project that enabled the team to develop and adhere to a research protocol that met legal, scientific, and ethical requirements. This included the right to redistribute the device to research participants, the ability to create, access, and monitor online accounts on behalf of research participants, and the right to receive and use data collected on the device as part of the research study, including for non-commercial publications. The terms of use also ensured that Fitbit[®] would not know or have the right to know the identity of any research participant.

Project email accounts used only alphanumeric identifiers and no personally identifiable data, either in the naming of the account or in any details therein. Moreover, these numeric identifiers were different from any other project codes used on, consent documents, or respondent tracking systems. Although many research projects have used devices that gather geographic information along with activity levels, NYCHANS wanted to assure participants that no geographic information would be collected. The Fitbit[®] Flex does not contain a GPS locator, which was considered an asset in selecting a device as this would have required substantial efforts to protect these data.

Incentive distribution for the actigraphy supplement followed similar practices to those used in the NYCHANS interviews. Because the City of New York, as the data collection partner of NYCHANS, required receipts and monitoring of distribution for audit purposes, all documents related to incentives were kept separately from any research materials (including consent and other identifiable information) such that only project staff could link a receipt to a specific study participant's data.

⁷ Fitbit[™] has since released the Fitbit Ace, which is currently marketed for children ages six and older.

4. Field Procedures

4.1 Eligibility

Every adult that completed a caregiver interview at the project's offices was eligible for the actigraphy module as was each of the teens (age thirteen to eighteen) who lived with them and accompanied them to the office appointment.

For a subset of families that could not come to the project's offices or where the caregiver completed a short-form interview (n=132), both caregivers and teens were considered ineligible for the actigraphy supplement.⁸

4.2 Consent and Assent

Consent and assent for the actigraphy module were obtained separately from the interview for both caregivers and teens. Caregivers were given a consent booklet with information about each component of the study, including what participation would entail for them and for each child, based on age.

Caregivers that provided consent to be interviewed were able to decide separately whether they wanted to participate in the actigraphy module or not, which eligible child could be interviewed, and which eligible teens could participate in the actigraphy module. Participation in the caregiver interview was required to be able to provide consent to the actigraphy module and any child component of the study. The NYCHANS team guided each caregiver through the entire set of information before asking for consent to any one piece. Caregivers who wanted more time to consider giving consent to actigraphy for themselves and/or their children being interviewed could come back at the end of the caregiver interview to make final decisions.

Each youth for whom the caregiver gave consent was given a booklet that was similar in content and scope to the caregiver consent booklet, but written in age-appropriate language. Each youth was asked to give written assent to be interviewed and separately assent to participate in the actigraphy module. Any youth could choose to participate in one, both, or no components so long as the caregiver provided consent for them to participate. Table 1 shows the consent and assent rates for the actigraphy supplement, by treatment and control groups.

Table 1: Consent and Assent Rates for Caregivers and Teens, by Group Assignment

	Treatment		Control		Total	
	n	%	n	%	n	%
Caregiver Consent						
Self	192	91.0	266	93.3	458	92.3
Youth	75	89.3	112	90.3	187	89.9
Youth Assent	73	97.3	110	98.2	183	97.9
Total	265	89.8	376	91.9	641	91.0

4.3 Post-Interview Procedures

At the conclusion of the caregiver and youth interviews, everyone who had provided consent or consent and assent to the actigraphy module was measured for a wristband and shown a set of ten sample wristbands from which to select a color. Small and large

⁸ Children were also deemed ineligible to be interviewed, as all minors were required to be interviewed at the project's offices with a caregiver present.

wristbands were available in black, slate, navy, blue, teal, lime, tangerine, red, violet, and pink (Figure 1 shows the distribution of wristband color selected by participants in this order of colors from left to right). Extra-large wristbands were only available in black.

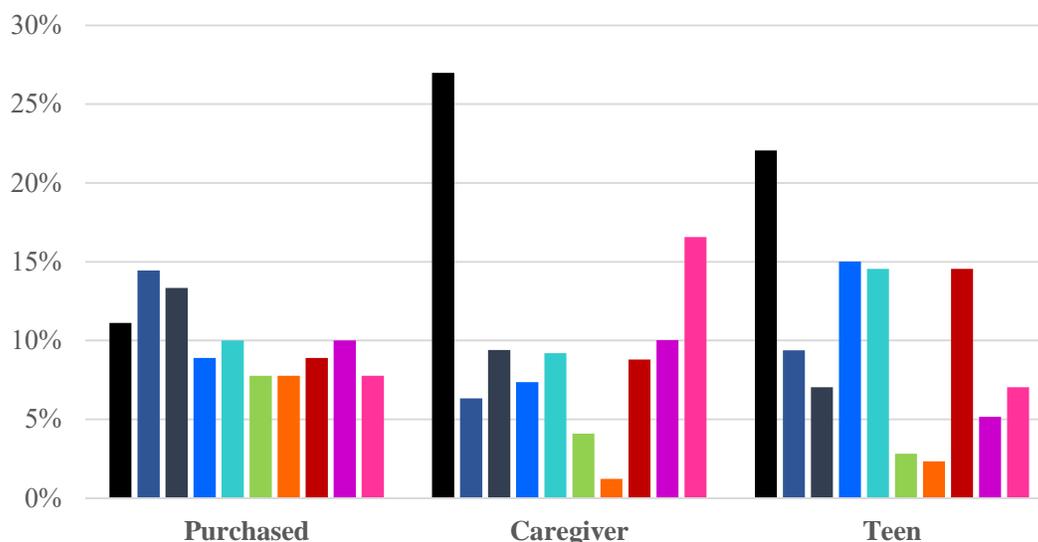


Figure 1: Color of actigraphy wristband selected by caregivers and teens compared to distribution of colors purchased for NYCHANS

Devices, which had already been fully charged and linked to a project-specific email account prior to the start of the interview appointment, were inserted into the wristbands and placed on each participant's non-dominant wrist. The caregiver was asked to make a follow-up appointment for about a week later, at which time s/he and any participating youth were asked to return with the device. Participants that had to come back more than a week later could do so but asked to continue to wear the wristband until they were able to return.

Each participant was given a brief FAQ about the wristband along with an appointment date and time. Reminder calls were offered for the day prior to the follow-up. Any individual that had to reschedule could do so.

4.4 Actigraphy Close-Out

At the follow-up appointment, each participating caregiver and youth was asked to give the Fitbit® to project staff who charged the device (as needed) and synced the data to the project account using a project tablet. Staff verified that the device could be synced (i.e., that it had not been linked to another account) and that at least one day of data was visible in the Fitbit® dashboard.

Participants were asked to choose their incentive and both participant and interviewer signed a receipt indicating that the chosen incentive had been received. For participants who chose the debit card, the staff de-linked the device from the project email account for future use; wristbands were discarded. For participants who chose to keep the Fitbit®, the device was delinked from the project account and returned to the participant with instructions on how to link it to their own account.

4.5 Incentive Structure

Each participating caregiver and youth was given a thank you for participating in the actigraphy module. This thank you was separate from the thank you that each participating adult, child, and youth received for participating in an interview. The incentive for the actigraphy module was given at the conclusion of the seven-day actigraphy field period when the participant returned the device; receipt of the incentive was contingent upon having at least one day of data that could be retrieved.

Adults and youth were offered the choice of either keeping the Fitbit® which they had worn for the previous week or returning the device and receiving a debit card with \$120 pre-loaded onto the card. Each caregiver and youth could make an independent decision. The overwhelming majority selected the debit card (only six participants who returned the device with adequate data opted to keep the device).

5. Data and Measures

5.1 Structure of the Data

Minute-level data and day-level summary information were downloaded via the Fitbit web API for each device that was returned (n=618) using Python script adapted by the NYCHANS team.⁹ Day-level summary information was also downloaded in excel format from fibit.com for each device/participant. Data files were appended and merged to create a raw minute-level dataset with one row for each minute of data, nested within days, nested within participants, nested within families.

5.2 Defining the Analytic Datasets

Data on physical activity and sleep varied in quality and completeness. For this reason, NYCHANS created two separate minute-level analytic datasets—one for physical activity and one for sleep—using different inclusion and exclusion criteria that addressed the challenges and analytic needs of each. Out of the total of 630 devices that were returned, 12 devices had technical problems where the project staff were either unable to log in to the account (n=9) or there were no recorded data (n=3). These cases were excluded from both analytic datasets, even though the participants gave consent/assent.

5.2.1 Physical Activity

Minute-level data were available for 618 devices. We began by excluding records from the first day of the data collection period (the interview day) and the day the device was returned (the follow-up appointment). This was necessary as the device records information at all times; therefore, some of the first data collected on the interview day and some of the last data collected at the follow-up appointment capture movements of project staff who set up the device and retrieved data. By excluding these days in their entirety, we took a conservative approach that ensured all of data captured by the device were *during* the field period itself and include a full 24-hours of recorded data.

We identified spells of non-wear time using minute-level physical activity data on METs, steps, and sleep. Periods of no activity were defined as consecutive minutes of 1 MET and 0 steps with no sleep recorded during the period. These periods vary in length from one minute to over seven days and are highly skewed, with an average length of 8.6 minutes (8.9 minutes for teens and 8.5 minutes for caregivers).

⁹ Python code was adapted from publicly available, open-source code.

Because we cannot distinguish between periods of no recorded activity in which a user did not move and those when the device was not worn, we use a high threshold of 12 hours or more to define non-wear time. Across all participants, 25 percent had one or more period of non-wear lasting 12 or more hours (26 percent for teens and 24 minutes caregivers). There were no significant differences between treatment and control groups in the prevalence of non-wear periods ($\beta = -.004$, $p = .90$) or the total number of non-wear periods ($\beta = .037$, $p = .52$).

	All devices that were returned	>	Exclude any devices where data could not be retrieved	>	Exclude days with one or more non-wear period of 12 hours or more
			<i>Records with Minute-level Data</i>		<i>Records in analytic dataset</i>
Adults / Caregivers	450 devices / participants	>	3,996,000 minutes; 2,775 days; 440 devices / participants	>	3,513,604 minutes; 2,444 days; 420 devices / participants
Teens 13+	180 devices / participants	>	1,599,840 minutes; 1,111 days; 178 devices / participants	>	1,396,804 minutes; 974 days; 172 devices / participants
All Participants	630 devices / participants	>	5,595,840 minutes; 3,886 days; 618 devices / participants	>	4,910,408 minutes; 3,418 days; 592 devices / participants

Figure 2: Inclusion / exclusion criteria for the physical activity analytic dataset

For the final analytic dataset, we exclude all minute-level records from calendar days in which there was one or more non-wear period of 12 hours or longer. This brings the final analytic dataset for physical activity to 4,910,408 minutes across 3,418 calendar days and 592 devices / participants.

5.2.2 Sleep

Participants were asked to wear the device 24 hours a day, except for when bathing or swimming. The Fitbit[®] is programmed to recognize and record sleep without the participant needing to indicate the start or end time on the device. Despite these factors, many devices failed to record sleep each day. While some participants may not have slept for one or more days during the field period, the high number of days without recorded sleep clearly shows that participants either failed to wear the device while asleep or the device failed to record many sleep periods. Out of the 3,886 days of recorded activity across 618 participants, only 61 percent of days ($n=2,363$) recorded any sleep activity and only 80 percent of participants ($n=502$) had any sleep recorded. There were no significant differences between treatment and control groups in the prevalence of having any sleep recorded at all ($\beta = -.023$, $p = .46$), the total number of days with any recorded sleep ($\beta = -.083$, $p = .67$), or the share of total days of retrieved data with one or more recorded period of sleep ($\beta = -.015$, $p = .62$).

For the analytic dataset, we exclude all minute-level records from days without any recorded sleep. This brings the final analytic dataset for physical activity to 3,402,720 minutes (949,924 sleep minutes) across 2,363 calendar days and 502 devices / participants.

	All devices that were returned	>	Exclude any devices where data could not be retrieved	>	Exclude days within no sleep recorded
			<i>Records with Minute-level Data</i>		<i>Records with sleep time</i>
Adults / Caregivers	450 devices / participants	>	3,996,000 minutes; 2,775 days; 440 devices / participants	>	2,543,040 minutes; 1,766 days; 362 devices / participants
Teens 13+	180 devices / participants	>	1,599,840 minutes; 1,111 days; 178 devices / participants	>	859,680 minutes; 597 days; 140 devices / participants
All Participants	630 devices / participants	>	5,595,840 minutes; 3,886 days; 618 devices / participants	>	3,402,720 minutes; 2,363 days; 502 devices / participants

Figure 3: Inclusion / exclusion criteria for the sleep analytic dataset

5.3 Measures Captured

Below, we describe the use of the minute-level data to derive various summary variables and show distributions of the data received. This is not meant to be exhaustive; rather, it provides a roadmap for the variety of variables that can be generated based on the actigraphy data collected.

5.3.1 Physical Activity

Steps per minute was used to calculate total steps per day, average steps per day, and average steps per week. The total number of steps per day ranged from 0 to 46,541, with an average of 9,412 (9,081 for teens and 9,545 for caregivers). Average steps per week was interpolated based on average steps per day for those with fewer than seven days of data.

METs expended per minute ranged from 1 to 13.1 and was used to calculate the total number of minutes per day of different intensity levels. Moderate activity was defined as having expended 3 to 6 METs. Vigorous activity was defined as having expended 6 METs or more. These values were used to estimate the amount of time per day or week spent doing moderate- or vigorous-level intensity activities in order to compare against CDC recommendations for physical activity for teens and adults.

Figures 4 and 5 show the distributions for two of these measures—total steps per day and total minutes of moderate-intensity activity per day.

Number of Actigraphy Days

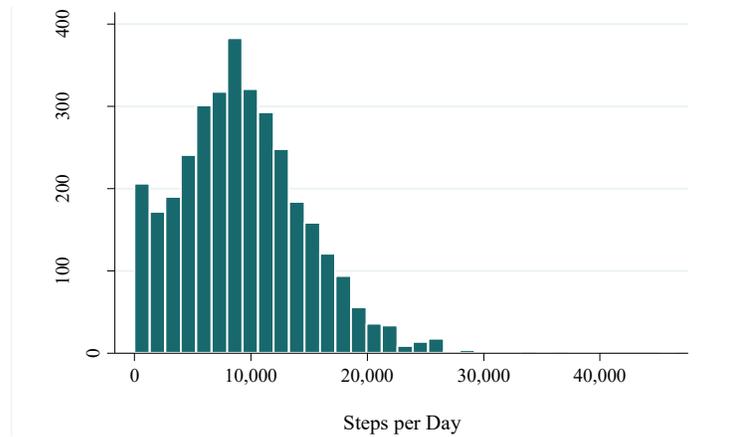


Figure 4: Distribution of total steps per day
(n=592 caregivers and teens; 3,418 days)

Number of Actigraphy Days

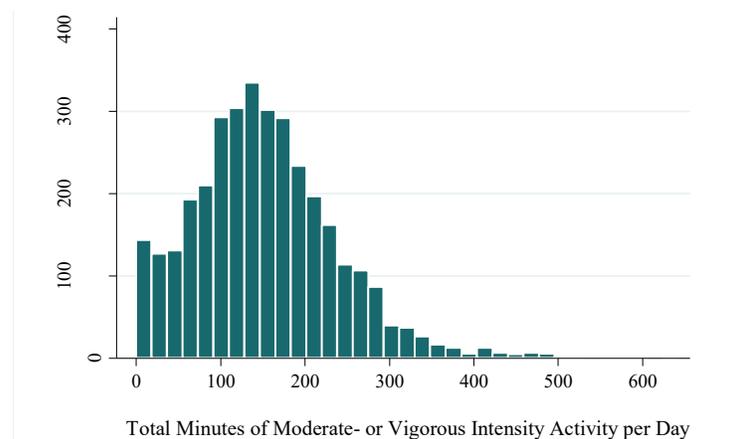


Figure 5: Distribution of minutes per day of moderate-intensity activity
(n=592 caregivers and teens; 3,418 days)

5.3.2 Sleep

*Minutes recorded as sleeping*¹⁰ was used to calculate amount of time asleep and the average length of sleep per day. Time stamps were used to determine a variety of secondary measures, such as whether individuals were asleep during the day or at night, the time of sleep onset and when the participant awoke, and consistency of sleep schedule, among others.

We defined each day's 'main sleep' period as the longest sleep period that occurred on a given day, regardless of the day in which the period began or ended. Main sleep periods

¹⁰ Fitbit classifies whether the individual is asleep, restless, or awake during each minute of sleep. NYCHANS considered any minute with any of these three sleep statuses as sleep, preferring instead to rely on activity data (i.e., METs) to classify sleep status directly.

were assigned to the calendar day in which the majority of sleep minutes were recorded.¹¹ For example, a respondent who had a main sleep period from 10pm until 6am would be classified as having slept eight hours and would be reported on the second day when 75 percent of the sleep minutes were recorded.¹² Figure 6 shows the total hours of main sleep per day.

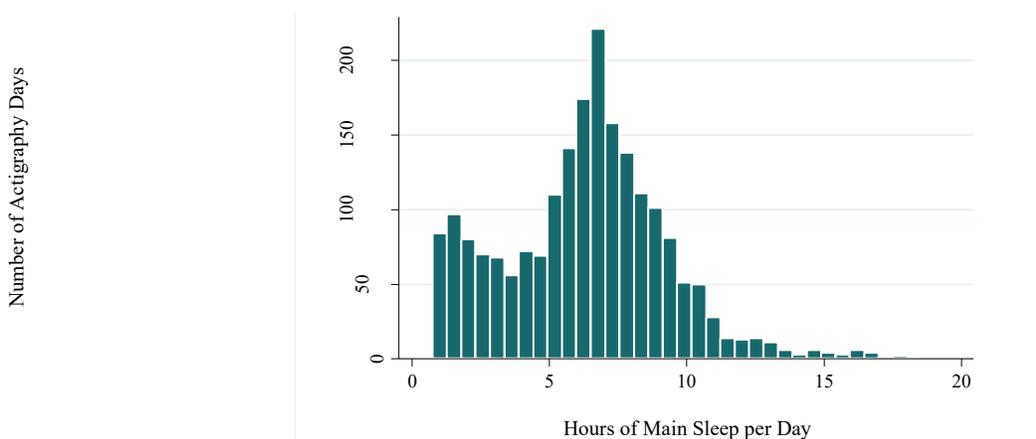


Figure 6: Distribution of total main sleep per day, in hours (n=502 caregivers and teens; 2,048 days)

6. Conclusion

This paper provided details on the actigraphy module of NYCHANS, which supplemented data obtained from face-to-face interviews for a subset of participating caregivers and teens. Several aspects of the research protocol ensured its success. This included the selection of the Fitbit Flex[®], a consumer activity tracker that made it easy for participants to comply as it did not require any charging or download of data during the seven-day field period, the offer of a healthy incentive for participation (\$120 or keeping the device), and the integration of consent/assent during the face-to-face interviews. Of the 704 caregivers and teens that were eligible for the module, 641 gave consent / assent (91 percent). The vast majority of participants returned the device (there were 11 break-offs) and had at least some data recorded (12 devices had no data retrieved).

Data quality varied for physical activity and sleep, which resulted in two distinct approaches to processing the data for analysis. For physical activity and sleep, there was a substantial amount of time with no recorded activity. Despite this, 592 devices provided valid data of sufficient quality (92 percent of those that gave consent/assent). Sleep data were more problematic, with many days of no recorded sleep. Overall, 502 devices provided valid data of sufficient quality (78 percent of those that gave consent/assent). There were no significant differences between treatment and control groups across a number of measures of data quality.

¹¹ Additional sleep periods (e.g., naps) were also recorded, which could either be added to the main sleep period or as part of an alternative way of calculating sleep time within a 24-hour window, rather than by sleep period.

¹² Not every day in the sleep analytic dataset has a main sleep period. Of the total 2,363 days with any sleep data, only 2,048 days have a main sleep period. In the example above, both days have some sleep minutes recorded (2 hours on the first day; 6 hours on the second); however, only the second day is 'credited' for the sleep period to avoid double-counting sleep periods. If there was no main sleep period from the prior night assigned to the first day, then only one of the two days will indicate a main sleep period.

Although the development of the actigraphy module added complexity to the protocol, the end result provided novel data that would not otherwise have been captured through self-report alone. Moreover, the module was relatively inexpensive to implement and did not result in lower interview response rates, as respondents were able to separately decide whether they would like to participate in the supplement. NYCHANS provides a case study of how a social survey can successfully implement an actigraphy module that supports the analytic aims of the overall project without detracting from the primary data collection effort.

Choreographing “the Best Interview Ever”: Developing and Implementing a Multimodal Family Interview

Caitlin R. Waickman¹, Daniel Goldstein¹,
Linda M. Powell¹, Elyzabeth Gaumer¹

¹ New York City Department of Housing Preservation and Development, 100 Gold Street, New York, NY 10038. The views expressed here are those of the authors and do not necessarily reflect those of the Department of Housing Preservation and Development or the City of New York.

Abstract

Many social surveys collect large amounts of data through multiple modes. This often translates into significant demands on respondents’ time, a barrier to recruitment. The NYC Housing and Neighborhood Study (NYCHANS) is a large-scale RCT assessing the impact of affordable housing on low-income New Yorkers. We seek to interview multiple respondents in a single family at one appointment with multiple modules. We discuss in this paper how our guiding principles—(1) respect the respondent and (2) work collaboratively across all levels of the project—reduce burden and produce high quality data. We present details of our appointment choreography, interview structures, and Interviewer training. Interview protocol focused on respondent experience and comfort. To this end, we conduct highly choreographed and structured appointments with carefully tailored consent/assent booklets and multimodal data capture including CAPI, CASI, and breakout cards. These principles can be used by any data collection effort to increase efficiency and effectiveness by incorporating carefully planned, multimodal instruments, within structured interview appointments.

Keywords: multi-mode, data quality, respondent burden

1. Introduction

Survey researchers aim to collect valuable, high quality data in an interview environment, but it can be a challenge to efficiently collect sufficient data within a limited amount of time. Researchers must also avoid undue burden on the respondent during the interview. Without careful planning, an interview can become a cumbersome list of questions that is taxing for both Interviewers and respondents.

Careful planning of interview structure, flow, and timing can help to alleviate respondent burden. By including multiple modes and interviewers, respondents of all ages can be engaged throughout the interview. A thorough training for Interviewers can also help to ensure that they are able to expertly and efficiently administer an interview and adjust as necessary.

In this paper, we discuss the choreography of a variety of interviews conducted as part of the New York City Housing and Neighborhood Study (NYCHANS). We provide detail on each interview component, data collection modes, and Interviewer roles. Each element of planning contributed to an interview that collected a large amount of data without

burdening respondents. In the following sections, we focus primarily on in-office interviews with multiple respondents.

2. The NYC Housing and Neighborhood Study

NYCHANS is a randomized control trial that evaluates the impact of affordable housing on the health and well-being of low-income households. It is a natural experiment that leverages the existing housing lottery system used by the City of New York to identify two groups: those that were offered an affordable housing unit (“treatment”) and those that were eligible for those same units but not offered housing because demand exceeds supply (“control”).

NYCHANS follows treatment and control households that applied to live in one of thirteen affordable housing developments (“study sites”) located in six neighborhoods in Manhattan, Brooklyn, and The Bronx. The study sites are newly constructed developments built between 2011 and 2015. NYCHANS includes a total of 900 low-income affordable units¹ ranging in size from studios to three-bedrooms; income eligibility ranges from 40 to 80 percent of HUD Income Limits.² Each study site held its own lottery following standard City guidelines for its marketing and lease-up process. All study participants lived in New York City at the time they applied for affordable housing.

3. Key Project Components

The research team collected a wide range of information to measure the overall impact of moving into affordable housing on low-income households. Data collected included unit-level measures about the home in which participants lived, household-level measures about the applicant households as a unit, and individual-level measures about the respondents and/or other co-resident household members, including children.

3.1 Study Participants

About 628 of study participants that completed interviews listed children on their application for affordable housing. They were eligible for the “caregiver” interview. Participants that did not apply with children were interviewed as “householders.” Up to two children in caregivers’ households were also invited to participate. Those between the ages of 8 and 13 were invited to participate in a “child” interview, while those 13 to 18 years old were invited to participate in a “teen” interview.

Householder Interviews were conducted with one adult in the household. These interviews took place at the study participant’s homes, although they were also offered interviews at the project offices or another place of convenience for them, if they

¹ This is the number of units included in the study and does not represent the total number of residential units in these developments. Some developments also include higher-income affordable units and/or market-rate units that were beyond the scope of NYCHANS. In some instances, only a subset of the low-income affordable units was included in the study; this was done to balance the distribution of unit types within and across study sites.

² In Fiscal Year 2020, this is equivalent to between \$37,560 and \$75,120 for a family of three; however, a household with a voucher may earn less than the minimum income to qualify for a unit. Actual income eligibility criteria were determined based on the year of the housing lottery for that development.

preferred. Caregiver, teen, and Child Interviews took place at the project offices, in a city government building.³

3.2 Content Areas

Because NYCHANS conceived of housing and its effects in broad terms, the research team did not limit its investigation to housing-related outcomes. Instead, the team collected information spanning many areas. All adults — householders and caregivers — were asked core questions, while caregivers were asked additional questions related to caregiving and their children. Children and teens were asked questions relevant to them.

3.2.1 Adult Content

All adult respondents were asked about their housing cost and quality as well as their perceptions of their housing cost and quality. Adults were also asked about their neighborhoods; they were asked to provide their own definition of its scope and their sense of its safety, quality, amenities, and affordability. Adults were asked about social aspects of their neighborhoods such as collective efficacy and disorder.

Beyond housing and neighborhoods, adult respondents were asked about their physical health, mental health, health behaviors, and access to healthcare. Physical health questions included overall self-rated health, asthma and diabetes diagnoses, and body mass index, both self-reported and objectively measured. Mental health items included measures of depression, anxiety, stress. Health behavior questions included diet and nutrition, smoking, alcohol consumption, overall physical activity and exercise level, and sleep measured using the Pittsburgh Sleep Quality Index (PSQI) (Buysse, et al. 1989). Respondents were also asked about their financial stability, including overall household income and debt as well as delay of critical expenses.

Respondents were asked to provide a full roster of all household members as well as demographic and income and employment information about all adults. Respondents were also asked to provide a five-year residential history, along with all members of their current and previous households. Finally, all adult respondents were asked about their social context, including a constructing a formal egocentric social network and answering questions about neighboring behaviors and collective efficacy within their buildings.

3.2.2 Caregiver Content

Caregivers were asked not only the same core questions as householders, but also additional questions about caregiving and parenting. As an additional measure of financial stability, caregivers were asked about child savings and investment and childcare cost and quality. They were asked questions about parental stress and engagement, family daily routine, homework and screen time, and their children's extracurricular activities. Caregivers were asked questions about intergenerational closure in their neighborhoods. Caregivers were also asked about their children's health, including blood lead levels, doctor visits, and dental care.

Objective health measures were also collected from caregivers, teens, and children, including blood pressure for caregivers and height and weight for caregivers, teens, and

³ Caregivers were offered an alternative at the end of the NYCHANS field period. A short, fifteen-minute version of the survey was offered in their home. This “short form” interview collected key measures and were completed as a CASI on a tablet. Most of these interviews were completed in respondents' doorways.

children. Caregivers and teens were invited to wear an actigraphy wristband for the week following the interview appointment as part of a supplemental module on physical activity and sleep.

3.2.3 Child/Teen Content

Teens were asked about their homework, school environment, and screen time. Teen Interviews also included questions on caregiver supervision and discipline. Teens were also asked about their physical activity and nutrition. Just as in the Householder and Caregiver Interviews, teens were asked to construct a formal egocentric social network. Teens were asked about risky behaviors among peers in their social network. Teens also answered questions on their mental health and their own risky behaviors. A subset of teens was also asked to define the boundaries of their neighborhood. Teens answered questions about their neighborhood including questions on collective efficacy, social cohesion, and safety.

Child Interviews included a subset of questions from the Teen Interview, including questions on school environment, caregiver relationship, and routine.

4. Structure and Content of the Family Interviews

In order to conduct such comprehensive interviews, the NYCHANS research team utilized multiple modes of data collection to break up the interview and hold the respondents' interest. The modes of data collection in the Caregiver Interview included:

1. Interviewer-Administered (CAPI)
2. Interactive Interview Cards
3. Self-Administered (CASI)
4. Objective Health Measures (OHM)
5. Actigraphy
6. Interviewer Observations

A multi-modal approach to interview appointments allowed the research team to separate interviews into smaller components and incorporate breaks. The structure of each interview differed based on (1) whether interviews were conducted in the project offices, in the respondents' home or elsewhere and (2) whether the respondent was a householder, caregiver, teen, or child. Below, we discuss each mode of administration and its content.

4.1 Interviewer-Administered (CAPI)

During the CAPI portion of the interview, questions were read by an Interviewer off a project tablet. Interviewers also entered answers into the tablet, which then determined the logic of later questions. The CAPI included questions on all key interview components mentioned above. For child and Teen Interviews, the CAPI ended in the Peabody Picture Vocabulary Test, 4th Editions (PPVT-4) (Dunn and Dunn. 2007).

Respondents were shown response cards for most questions. Response cards were compiled into answer guide booklets with attached stands that allowed Interviewers to flip back and forth between cards. The cards allowed respondents to consider each answer option, without the wasted time of the Interviewer reading each answer out loud. PPVT-4 (Dunn and Dunn. 2007) also required its own set of response cards with pictures for each vocabulary word.

NYCHANS Interviewer-administered CAPI questionnaires varied in length and content across householders, caregivers, teens, and children. See below for the average length of interview by type.

Table 1: Length of Interview by Type

Interview	Length
Householder	60 minutes
Caregiver	90 minutes
Teen	45 minutes
Child	30 minutes

4.2 Interactive Interview Cards

Interactive interview cards were interspersed throughout the interview. These cards allowed the team to collect visual or narrative data that may otherwise be difficult to capture. Interactive cards also provided privacy for potentially sensitive questions.

- *Neighborhood Definition Card* - Respondents were asked to draw a map of their neighborhood and label its boundaries on a blank card.
- *Residential History Card* - Interviewers collected the respondent's five-year history of addresses and household compositions.⁴
- *Social Network Roster* - Respondents were asked to provide names or initials of their social ties, including bridging and bonding ties in their neighborhood and building.
- *Social Network Density Card* - Interviewers asked which of the respondent's social ties interacted with each other regularly.
- *Mental Health Card* - Respondents answered questions about their mental health using the Patient Health Questionnaire – 8 (Kroenke, et al. 2009) and GAD-7 (Spitzer, et al. 2006) on a card that was filled out without Interviewer involvement.⁵

4.3 Self-Administered (CASI)

In Caregiver Interviews, CASI allowed Interviewers to give the respondent a break from verbal responses, as it was completed on a tablet and didn't require any Interviewer guidance. CASI content included:

- Child Health
- Family Routine
- Caregiver Mental Health
- School-related Activities
- Child Discipline
- Child Nutrition
- Child Behavior Checklist (CBCL) Anxious/Depressed and Aggressive Behavior scales (Achenbach. 1991).

⁴ In Householder Interviews, residential and household composition history was collected only for the respondent. In Caregiver Interviews, residential and household composition history was collected for the caregiver as well as one focal child.

⁵ The Mental Health Card was only used during Householder Interviews. For Caregiver Interviews, mental health questions were administered as part of the CASI questionnaire.

CASI interviews allowed respondents privacy to answer questions that were potentially sensitive. Interviewers made it clear that they would not be looking at the respondents' CASI answers. CASI also helped to save time. While some respondents were not used to working on a tablet, the interface of the CASI was intuitive and helped respondents to quickly move through questions that may otherwise have taken more time to read aloud.⁶

4.4 Objective Health Measures (OHM)

Interviewers collected objective health measure for caregivers, teens, and children. These included blood pressure for caregivers and height and weight for caregivers, teens, and children. Height, weight, and blood pressure were all measured electronically by using medical-grade devices⁷.

The timing and choreography of the health measures were key to ensuring valid measurement as well as comfort of the respondent. Caregivers had to be seated for five minutes before their blood pressure could be measured, so Interviewers rolled in an automatic blood pressure monitor as soon as the interview finished, while the respondent was still seated. Height and weight were taken in an adjacent room, where caregivers could keep their children within eyesight, but none of the respondents were able to read others' height and weight measurements.

4.5 Actigraphy

While the actual actigraphy measurements took place during the week following the interview appointment, participating caregivers and teens had to be educated on the process and equipped with the wristband before leaving the project offices. These minor additions had the potential to take up valuable appointment time. If a caregiver and/or teen consented to the actigraphy module, over the course of the appointment Interviewers were sure to:

- Explain guidelines for the actigraphy module:
 - Participants were to wear the wristband for a week following the interview appointment. They would wear it all day and all night.
 - The wristband should only be removed if it was going to get wet.
 - Participants should not sync the wristband with their own accounts.
 - They were responsible for returning to the office to turn in the wristband and receive a monetary “thank you” at the end of the week.
- Measure the participant's wrist for a small, large, or extra-large wristband.
- Allow the participant to pick their preferred wristband color.
- Give the participant their wristband (synced with their assigned account) and show them how to take the wristband on and off.
- Set up a follow-up appointment to return the wristband.

4.6 Interviewer Observations

Over the course of the appointment, Interviewers observed the interactions between the caregivers and their teens and children. These observations started as soon as families arrived and were recorded after families left the office. Interviewers scored interactions

⁶ This depended on the respondents' familiarity with using a tablet and comfort reading, though. Some respondents took longer to fill out a CASI than they would answering questions out loud.

⁷ For height and weight, the research team used a SECA 284 Wireless 360 Measuring Station. For blood pressure measurements, the team used A&D Medical Automatic Blood Pressure Monitor (TM2657P).

on two 5-point Likert scales. These qualitative measures were based on Interviewer observations over the course of the entire interview appointment.

4.7 Order of Components

In order to break up what would otherwise be an overwhelming interview, all interviews were mixed by mode. Changes in mode allowed respondents to not only switch their focus, but also allowed them to interact with different Interviewers over the course of the appointment. As discussed later in Section 8, Interviewers were trained to know the sequence and timing of each component of the interview. This avoided any lags in the interview and helped one component to flow seamlessly into the next. There were no pauses or wasted time for any of the scheduled appointment time. The diagrams below represent the order of each component of the interview, by interview type.

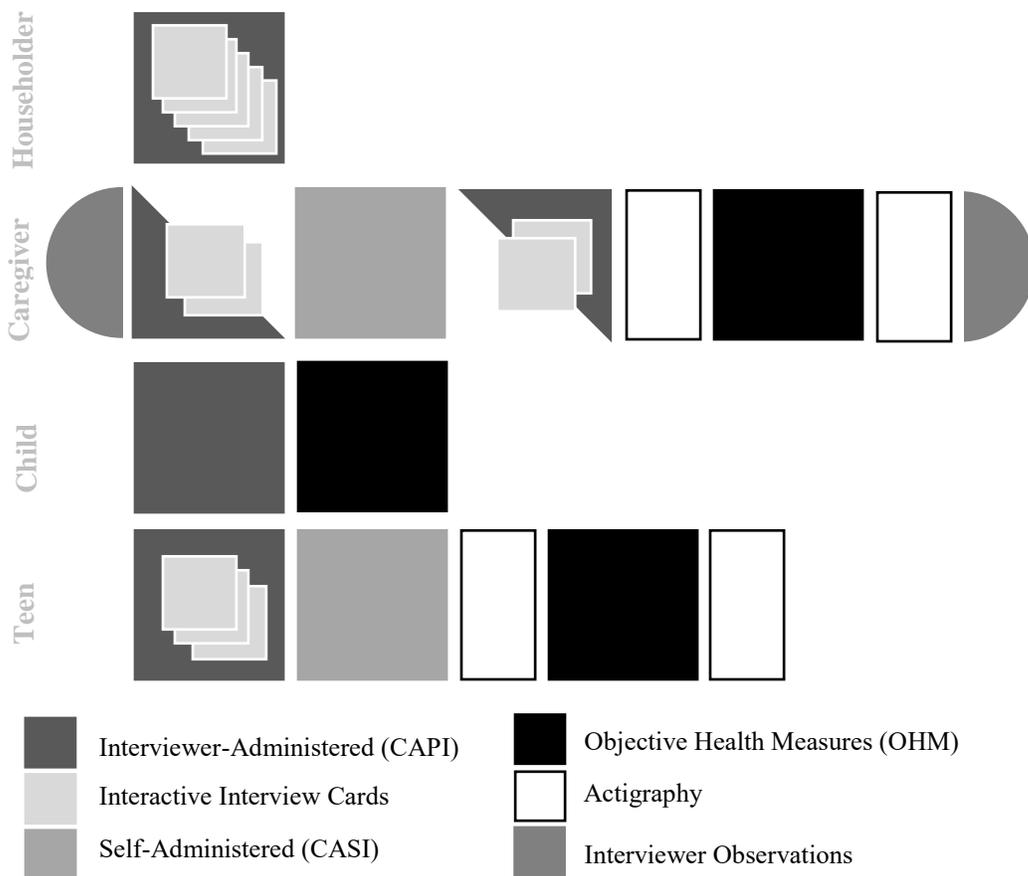


Figure 1: Mode and Sequence by Type of Respondent

5. Using Paired Interviewers

All interviews with adults (both householders and caregivers) were conducted with two Interviewers from the research team. Each Interviewer was assigned one of two distinct roles that were designed to ensure both data quality and respondent comfort. The research

team codified these roles and trained Interviewers on how to inhabit each one. The two roles were referred to as “First Chair” and “Second Chair.”

First Chairs were responsible for reading the CAPI instrument out loud and entering responses. They focused on accurately capturing data and monitoring the pace of the interview. First Chairs engaged with the respondent during the interview but kept their attention on the data collection process.

Second Chairs stayed focused on the respondent. It was their responsibility to be on the respondent’s “team.” This took many forms over the course of the interview. Second Chairs administered consent, ensuring that respondents understand each component of the study and their rights as study participants. During the interview, they stayed fully engaged with the respondent, working to put them at ease. They helped to clarify questions if the respondent was confused, comforted and commiserated with the respondent if they reacted strongly to a question, and listened attentively and read the body language of the respondent throughout the interview.

Second Chairs also administered Interactive Interview Cards and took objective health measurements. This helped to break up the interview by alternating which Interviewer the respondent was hearing from. While the Second Chair was tasked with supporting the respondent over the course of the interview, respondents may have felt more comfortable with either Interviewer. Changing not only modes, but also Interviewers, ensured that the respondent was continually engaged with both Interviewers and reduced Interviewer-effects, as the roles of individual interview staff varied from one interview to the next.

Paired interviewing also helped improve data quality. Interviewers were less likely to falsify any data or make mistakes in the field protocol if there were two people responsible for its collection. This was also an important component of training, as senior research staff could do interviews *with* an Interviewer without altering the protocol or any procedures. This allowed the research team to address problems early and maintain high interview quality. Since Interviewers were also going into respondents’ homes, paired interviewing one way the research team worked to keep Interviewers safe.⁸

6. Choreographing Multiple Interviews and Modes of Data Collection

The research team had many aspects of the interview appointment to plan for prior to starting the data collection process. For Householder Interviews, there were multiple Interviewers and modes of data collection to organize in a variety of interview environments, including respondents’ homes, cafes, and parks, among others.⁹ For

⁸ Research staff took additional steps to ensure safety as well. A communication protocol was set prior to any fieldwork. Interviewers in the field used a coded location to communicate with senior staff at the office regarding their location, interview progress, and any issues they came across. There were never any issues of safety in the field.

⁹ Field staff were committed to doing interviews in any environment where the respondent felt at ease; however, each environment was assessed to ensure that the Interviewers would be able to maintain privacy from other household members as well as strangers. For example, an interview could take place in a café but the Interviewers arrived in advance to select a table that was removed from other seating and would encourage respondents to provide the letter choice from a response card whenever possible, rather than say the answer out loud. In respondents’ homes, other family members would sometimes be present, and Interviewers could ask that they either

Caregiver Interviews, there were multiple interviews (Caregiver, Teen, and Child) in project offices, as well as objective health measures, to collect.

For householder Interviewers, choreography started in the doorway of respondents' homes. Interviewers were trained to always stand side by side, within site of the peephole, a slight distance from the door. Once inside the home, Interviewers avoided sitting in such a way that they were both across from the respondent. Instead, the First Chair sat across from the respondent and the Second Chair sat to the side, in between the First Chair and the respondent. This triangle formation allowed both Interviewers to engage with the respondent, without sitting in such a way that may have felt intimidating or antagonistic. Interviewers achieved this seating arrangement in a variety of ways, by moving chairs, adjusting the angle of their body, or sitting on the floor. Respondents came from a variety of socioeconomic backgrounds and lived in a variety of living situations. If there was not enough seating for all those present in the interview appointment, Interviewers always made sure to be the one(s) sitting on the floor. Respondents' homes varied widely, but Interviewers were equipped with the training and experience to adapt and establish a careful interview environment, regardless of where they were.

Caregiver Interviews required more choreography than Householder Interviews, as they were longer and involved interviews with minors. Caregivers were scheduled to come in with up to two children between the ages of 8 and 18 for interviews. They were also welcomed to bring additional children if they could not find childcare. This required project staff to work efficiently to screen which family members were eligible, conduct interviews, and watch any additional children during the appointment. It was important that each participant be engaged over the course of the appointment to avoid boredom or frustration.

Each appointment involved a minimum of three Interviewers, although many appointments required additional staff to be available. Two Interviewers interviewed the caregiver, while another interviewed the children and/or teens in an adjacent room. Additional staff assisted with additional children as necessary. A senior staff member was present at each appointment as a "Supervisor on Call."¹⁰ This senior staff member often served as one of the Interviewers in an appointment.

The adjacent interview rooms were carefully planned and laid out. The two rooms were divided by soundproof glass windows that allowed respondents (caregivers, teens, and children), to see each other, but still enabled the research team to keep the interview confidential. The windows were large enough to establish clear sightlines, but not so large as to create a clinical atmosphere. Each room had a table and three chairs: one for the respondent and one for each Interviewer. Respondents were always seated in the chair that faced the other room. Each room also had soundproof glass that faced the reception and play area. This allowed caregivers to also see children that were waiting or playing during the appointment (and vice versa).

move to another room or (in the case of small apartments) relocate the interview to a lobby or community room.

¹⁰ Supervisors on Call were responsible for addressing any ethical breaches and for implementing action plans if there were any concerns for the safety of a respondent and/or child.

At the appointment time, one of the Caregiver Interviewers waited for the family to arrive in the lobby of the City government building where the project's offices were located. The Interviewer served as a friendly, helpful face as the family went through security in the lobby and helped to minimize delays. Once upstairs, the family sat down with one of the Caregiver Interviewers and one of the Teen/Child Interviewers for an overall introduction and screener. This not only clarified who came to the appointment and who would be participating in interviews, but also provided valuable interactions between the caregiver and the researchers that would be interviewing their child.

After the initial screener two Interviewers, the First and Second Chair for the Caregiver Interview, brought the caregiver into an interview room to begin the consent process. The Teen/Child Interviewer engaged with the children, played games, talked, and generally built rapport. In the interview room, the Second Chair, assisted by the First Chair, walked through each component of NYCHANS with the caregiver, guiding them through the consent process.¹¹

Caregiver	Child/Teen
Screener	
<hr/>	
PCG Consent	
PCG Interview	Child/Teen Assent
PCG Neighborhood Definition Card	Child/Teen interview
PCG Residential History Card	Teen Neighborhood Definition Card
PCG CASI	Teen Social Network Roster Card
PCG Social Network Roster Card	Teen Social Network Density Card
PCG Social Network Density Card	Child/Teen Vocabulary Assessment
PCG Actigraphy Supplement	Teen Actigraphy Supplement
PCG Objective Health measurement	Teen CASI
	Child/Teen Objective Health measurement
<hr/>	
Close-out, Actigraphy Follow-up Appointment	
<hr/>	

Figure 2: Caregiver and Teen/Child Appointment Components

The Caregiver Interview began directly after consent. Caregiver interviews started in CAPI format, with two interactive interview cards (a neighborhood definition card and a residential history card) interspersed. About two-thirds of the way through the interview, a CASI module allowed respondents a break from talking with Interviewers. The last third of the interview was CAPI, with two more interactive cards (social network roster and density cards).

Once the Caregiver Interview began, the child or teen was moved to the adjacent interview room where the assent process was initiated. Up to two Child/Teen Interviews were conducted while the Caregiver Interview was ongoing. Teen interviews were CAPI, with three interactive cards (neighborhood definition¹² and social network roster and

¹¹ Interviewers were also trained on the choreography of consent. The consent booklet was separated into sections, which allowed Interviewers to pause at the end of each section and make sure they addressed any of the respondent's questions before they were asked to sign consent forms.

¹² Neighborhood Definition Interactive Interview cards were administered during a subset of Teen Interviews.

density cards). They completed their CASI at the end of the interview, so they could sit on their own and complete it while Interviewers started on any additional teen or Child Interviews. Child interviews were entirely CAPI, with no interactive cards.

As soon as teen and Child Interviews finished, an Interviewer took their height and weight. All health measurements were taken in the room adjacent to the Caregiver Interview. If the teen assented to the actigraphy portion of the study, Interviewers explained all necessary details, took their wrist measurement, and let them pick their wristband color. They then waited and played until their caregiver finished their interview.

After the Caregiver Interview, caregivers were given the same explanation of the actigraphy device and allowed to pick their preferred wristband color. During that time, the other Interviewer rolled in an electronic blood pressure cuff. It was important that the cuff was portable. If the respondent had to stand and move to a new location, Interviewers would have to wait 5 minutes before taking a blood pressure measure. Instead, the respondent had been sitting for the whole interview and the blood pressure measure could be taken immediately. Interviewers then measured the caregivers' height and weight in the adjacent room.

After all interviews were complete and the family was seated in the waiting area, Interviewers quickly fitted participating respondents with activity wristbands and set up follow-up appointments. Each Interviewer gave a thank-you folder (including the incentive) to their respective respondents. Interviewers thanked the respondents for their time and accompanied them to the exit.

7. Efficiency of the Interview

Interviews varied in length and composition. Householder interviews were about 60 minutes long, with five breakout cards (four conducted collaboratively with the Interviewer and one self-administered). Interviewers were trained to use time effectively. One Interviewer would set up interview materials while the other administered consent. Both Interviewers would work together to move through the interview questions, continually directing the respondent's attention back to response cards and the question at hand.

Caregiver appointments were booked in 2-hour time slots¹³. Each moment of the appointment, from the time respondents entered the lobby, was used to build rapport and collect data. All Interviewers were trained to move efficiently and keep track of the pace of not only their own interview, but any interviews happening simultaneously. Two teen and/or Child Interviews could take place within the span of a Caregiver Interview. Teen interviews took about 45 minutes and Child Interviews took about 30 minutes. Interviewers monitored pacing and adjusted as necessary to ensure that a caregiver never had to wait after a 90-minute interview for their children to finish.

¹³ 2-hour appointment slots included time getting through security in the lobby, completing the screener, and finishing close-out, as well as the actual time spent in the interview.

8. Field Interviewer Training

Interviewers were acting as representatives of New York City, as well as researchers, so they needed to be prepared to act professionally and adapt to each unique interview environment. In order to prepare Interviewers, the research team developed two main guiding principles: (1) respect the respondent and (2) work collaboratively across all levels of the project to reduce burden and produce high quality data. Respect for the respondent took precedence. Interviewers were trained to pay careful attention to each respondent through deep listening and reading of body language. Project staff also taught, however, that the second guiding principle is key to completing the first. An interview that collects accurate data respects the respondent by accurately portraying the information they have provided and capturing their unique experience. An efficient interview respects the respondent by reducing burden, respecting their limited time, and ensuring that they feel they are contributing to important research that can make a difference in the lives of New Yorkers.

These guiding principles were the basis of a week-long training for NYCHANS Interviewers. Each Interviewer completed the training, including certification in the protection of human subjects and mandated reporter training,¹⁴ prior to any interactions with respondents. The guiding principles served as building blocks that led to further lessons on timing, choreography, body language, and tone. Each of these components was used to practice deep listening and establish a safe, respectful environment for respondents.

Interviewers were trained to mirror respondents' body language and volume of speaking. They paid close attention to how much respondents were leaning in and gesturing. They identified how close the respondent stood and sat to others and how often they made eye contact. Interviewer pairs used mirroring to make it clear that the respondent had control in the interview environment. Mirroring also helped to convey that the respondent was speaking with someone they could relate to and that no one would overpower them in the interview environment. These tools (taught during training) helped Interviewers to stay focused on the respondent during the interview and react to their needs.

Research staff were trained to utilize each moment in the appointment to establish rapport and collect accurate and comprehensive data. This was especially important as many participants worked multiple jobs and juggled school schedules. Their time was often difficult to schedule and could not be wasted once they were in the appointment. The CAPI questionnaire included a timing update that appeared regularly on the Interviewer's screen. This notification told them where they should be in the interview, based on how much time had passed. Interviewers were trained to adapt and make adjustments if interviews were going long.¹⁵

9. Conclusion

NYCHANS interviews required careful planning and choreography in order to collect a large amount of data from multiple respondents during an interview appointment. First, the research team designed an interview with multiple modes of data collection, including

¹⁴ See the Human Services Learning Center (HSLC) at <https://www.hslcnys.org/hslc/>.

¹⁵ Because respondent comfort always came first, Interviewers were empowered to skip questions or even entire sections if time was running out.

CAPI, CASI, and interactive interview cards. Modes changed multiple times over the course of the interview, which helped to keep momentum and the respondent's interest. Second, the research team utilized a paired Interviewer approach to interviews. Each Interviewer played a unique role and made sure the respondent was engaged throughout the interview. Paired interviewing also helped to ensure data quality, regardless of the appointment's location.

The research team also carefully choreographed each step of the interview. Interview components were arranged in a way that allowed Interviewers to efficiently collect data without wasting the respondents' time. This choreography was put into practice by Interviewers who had been thoroughly trained on each component of the interview, the choreography, and the research teams' guiding principles. Interviewers were trained to put respect of the respondent first in the interview environment, which led not only to high quality data, but happy respondents (of all ages) who enjoyed participating.

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