Title: Periodic Evaluations of Risk Assessments: Identifying Families for Homelessness Prevention Services

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Abstract

The New York City Homebase program is one of only a few comprehensive U.S. homelessness prevention programs. To ensure that in-depth services are provided to families most at risk of homelessness, Homebase utilizes a structured assessment, the Risk Assessment Questionnaire (RAQ), developed using 2004–2008 data. We evaluated the RAQ's performance in a more recent cohort of 48,450 families with children applying for Homebase services from 2013–2016, testing the predictive power of the current assessment, as well as the power of existing and potential new individual items, using Cox survival models to predict homeless shelter application. The RAQ threshold for in-depth services still effectively identifies shelter risk (13.7%, versus 5.9% for those below the threshold), suggesting that services are being directed to the highest-risk families. Simulations of a modified RAQ reflecting regression results and program leadership input present assessment adjustments to consider to improve its efficiency and predictive power.

Key words: homelessness prevention, risk assessment, social services, families

Introduction

About 580,000 people in the United States experience homelessness on a given night, according to January 2020 point-in-time estimates (U.S. Department of Housing and Urban Development, 2020). This represents a 2% increase from 2019 estimates. About 172,000 were people in families with children. With millions of Americans now behind on mortgage and rent payments due to the financial impact of the COVID-19 pandemic (U.S. Census, 2021), there is the potential for further increases in the population experiencing homelessness, particularly once Federal and local eviction moratoria expire (Parrott & Zandi, 2021). Homelessness is associated with a range of adverse outcomes compared to stable housing, including, in adults, higher rates of premature mortality, infectious diseases, mental health disorders, and substance misuse (Fazel, Geddes, & Kushel, 2014; Geddes & Fazel, 2011) and, in children, poorer school performance, poorer physical health, higher emergency health care utilization and hospitalizations, and more prevalent developmental and mental health problems (Bassuk et al., 1997; Gultekin, Brush, Ginier, Cordom, & Dowdell, 2020).

Programs to prevent homelessness may seek to reverse the conditions that lead to homelessness or to provide services to people at risk to help them avoid losing their housing. In the case of the latter, targeted form of prevention, a central task is identifying who is at risk. The current paper evaluates a Risk Assessment Questionnaire (RAQ) in use in New York City. It examines how well it has held up after a decade of use, and how it might be improved.

Homelessness prevention

Socioeconomic and housing market factors influence community-level homelessness rates, supporting the need for far-reaching prevention at the structural level (Rukmana, 2020). Due to persistent poverty and lack of affordable housing, the need to assist individuals in crisis and

divert them from shelter or the streets remains high. Focused programs to prevent homelessness attempt to address this need. These programs grew dramatically from 2009 to 2012**,** when the American Recovery and Reinvestment Act provided $1.5 billion for distribution to state and local governments through the Homelessness Prevention and Rapid Rehousing Program (HPRP). Homelessness prevention includes structural and systems level interventions to improve the economic, housing, and social conditions that lead to homelessness and provide resources to institutions serving those at high risk. Effective prevention also includes resources for individuals and households at imminent risk of homelessness to help them maintain stable housing, or, for those who have just become homeless, to house them quickly and prevent the negative outcomes associated with longer or recurring homelessness.

An emerging body of literature describes homelessness prevention frameworks across the United States (Evans, 2021; Shinn & Khadduri, 2020) and internationally (Dej et al., 2020), and several studies demonstrate the efficacy of homeless prevention programs. Many of the evaluated programs provide financial assistance alone. For example, the Homelessness Prevention Call Center (HPCC) in Chicago provides financial assistance to callers facing eviction (Evans, 2016). A study compared outcomes for eligible callers who received assistance to callers who were eligible but applied for funding when none was available. Although only 2% of callers entered shelter over the next six months, access to funds reduced the rate of shelter entry by 76%. A recent evaluation of new funding for homelessness prevention in Los Angeles County found that clients who received case management alone became homeless at nearly four times the rate as those who also received financial assistance (rental assistance and utility arrears) (von Wachter et al., 2020). As one might expect, deep housing subsidies to help families with rent over the long term also prevent homelessness. In a randomized experiment with

families eligible for or receiving Temporary Assistance for Needy Families (TANF), Wood et al. (2008) showed that Housing Choice Vouchers (the federally-funded deep housing subsidy which covers housing costs for low-income individuals and families) substantially reduced homelessness over a four-year period, especially for those at high risk.

Other programs offer assistance, such as legal counsel, that does not include financial aid. To date, such programs have been shown to successfully prevent evictions but not homelessness (Seron et al., 2001; Greiner, Pattanayak, & Hennessy, 2013). In addition to financial assistance and basic services to prevent homelessness, several studies have examined rental assistance alongside comprehensive services for those with greater needs. For example, research demonstrates the efficacy of Critical Time Intervention (CTI), a time-limited case management intervention in which comprehensive service planning, case management, and connections to community services are delivered in phases over several months. CTI was designed to prevent homelessness among individuals and families with mental illness, most often following discharge from hospitals, prisons, or other institutions (Herman et al., 2011; Barrenger, Draine, Angell, & Herman, 2017).

The aforementioned studies examine outcomes of participants (both individuals and families); other studies support the efficacy of homelessness prevention for reducing rates of homelessness across communities. While the funding distributed through the federal HPRP was not tracked individually (Cunningham et al., 2015), Piña & Pirog (2019) examined the associations between proximity to HPRP-funded providers and outcomes among K-12 students. On the school district level, on average, having an HPRP provider in the same county or being located closer to an HPRP provider reduced the number of homeless students by 8 to 12%. Effects faded as programs ended.

New York City's Homebase program, administered by the Department of Social Services/Human Resources Administration (NYC DSS/HRA), is the largest homelessness prevention program in the U.S. and predates the HPRP Federal funding. Homelessness prevention is particularly needed in New York City. It has among the highest numbers of people experiencing homelessness in the country: 77,943 in the 2020 single night point-in-time count (U.S. Department of Housing and Urban Development, 2021). Homelessness is different in New York City than in other U.S. localities in several ways. First and foremost, residents of NYC have a legal right to shelter (Coalition for the Homeless, 2020). Unlike in other localities, the vast majority (over 90%) of the City's homeless population is sheltered and more than half of homeless individuals are in households with children (U.S. Department of Housing and Urban Development, 2020). In contrast, in Los Angeles (the U.S. city with the second largest homeless population), only 28% of the homeless population is sheltered and only 19% is in households with children. Nationally, 61% of the homeless population is sheltered and 30% is in households with children (U.S. Department of Housing and Urban Development, 2020). At the same time, New York City has high housing costs; in 2019, 25% of renter households in New York City experienced severe rent burden (i.e., spent 50% or more of their income on rent), which is slightly higher than the national percentage of 22% (U.S. Census, 2022a). New York City also has a rental vacancy rate lower that is lower than the rest of the country (3% vs. 6%, using 2019 data) (U.S. Census, 2022b). Of the vacant units in New York City, even fewer are affordable (New York City Department of Housing Preservation and Development, 2018). Both high housing costs and low affordable vacancy rates contribute to trends in New York City homelessness (Honig & Filer, 1993).

The Homebase program serves both those living in the community who are at risk of shelter entry ("Prevention" clients) and those exiting homeless shelters ("Aftercare" clients). The program is more comprehensive than other programs that have been studied, as it provides customized support based on client need, including case management, landlord mediation, legal assistance, short-term emergency funding, mental health services, referral for substance use treatment, childcare, and assistance in obtaining employment and public benefits (City of New York, 2021; Goodman, Messeri, & O'Flaherty, 2016). However, Homebase services are not exhaustive; needs such as immediate emergency housing or long-term treatment for serious mental illness are better met by other units within DSS/HRA/DHS, other City agencies, and/or other organizations. Homebase sites are located throughout the city, and services are provided through the Homebase center closest to the client's location. To be eligible for Homebase services, families with children must live in New York City, provide identification, and meet an income limit of below 200 percent of the poverty line.

Homebase is one of the more well-studied homelessness prevention programs (Goodman et al., 2016; Greer, Shinn, Kwon, & Zuiderveen, 2016; Messeri, O'Flaherty, & Goodman, 2011; Rolston, Geyer, Locke, Metraux, & Treglia, 2013; Shinn, Greer, Bainbridge, Kwon, & Zuiderveen, 2013). One experimental study found that the program reduced shelter entry and cumulative nights in shelter in the two years following service receipt, compared to a control group of eligible families who, through random assignment, did not receive assistance (Rolston et al., 2013). Moreover, evaluation of the Homebase program's roll-out geographically, over time, showed that family shelter entries decreased in communities with Homebase prevention centers (Goodman et al., 2016).

Focusing services

Under the amount of Federal funding available (primarily provided through the United States Department of Housing and Urban Development (HUD)'s Homeless Assistance Grants, which is about $2.7 billion a year nationally (U.S. Department of Housing and Urban Development, 2022)), homelessness prevention programs cannot serve every individual or family who is eligible. As such, programs to prevent homelessness should be efficient as well as effective, making the most impact on homelessness as possible given funding constraints (Shinn & Cohen, 2019). Across studies, homelessness prevention has been found to have the greatest effects for those at highest risk of losing their housing (Evans, Sullivan, & Wallskog, 2016; Greer, Shinn, Kwon, & Zuiderveen, 2016; Shinn et al., 2013; Wood et al, 2008). Therefore, to reduce homelessness more with limited funds—to be as efficient as possible—programs must identify those at most risk of becoming homeless (O'Regan, Ellen, & House, 2021). Although service providers have risk frameworks based on clinical experience, research across health and human services finds that predictions based on statistical models are more accurate than predictions of providers' clinical or professional judgments (Grove et al., 2000; van Der Put, Gubbels, & Assink, 2019).

Several models have found that the best predictor of future homelessness is having been homeless before (Greer, 2014; Greer et al., 2016; Shinn et al., 2013; Doran et al., under review). Other significant predictors include doubling up in housing with family or friends or not having one's own lease, facing eviction, receiving public assistance, and having high rent arrears or other debts (Greer, 2014; Shinn et al., 2013; Shinn & Khadduri, 2020). In New York City, being pregnant, having a young child, past involvement with child protective services, and adverse childhood experiences have also been found to significantly predict shelter entry (Shinn et al., 2013). Behavioral factors, such as self-reported mental illness or substance use, domestic

violence, or criminal justice history, do not seem to add predictive power (Greer, 2014; Shinn et al., 2013).

Over the last decade, more communities have begun developing and using predictive modeling to focus scarce homelessness prevention services. While models tend to rely mostly on self-reported data (Greer et al., 2014; Shinn et al., 2013; Greer et al., 2016; Montgomery, 2021), in Los Angeles, researchers have integrated administrative data from multiple public agencies to create complex models. Toros, Flaming, & Burns (2019) aimed to identify risk of persistent homelessness for two critical groups: young adults 18 to 24 who receive public assistance and low-wage workers who have lost their jobs. The models are based on homeless history, employment history, past incarceration, foster care placement as a child, hospital emergency room visits, hospital inpatient care, outpatient medical and mental health services, medical diagnoses, and public assistance receipt, and have been shown to be highly accurate, especially for distinguishing persistently homeless individuals from those not persistently homeless (Toros et al, 2019). Another Los Angeles project uses predictive analytics to identify, among all single adults using mainstream services (such as emergency rooms), those who are most likely to become homeless and connect them to prevention services (von Wachter et al., 2019). The model uses many more factors than those based on self-report and single system administrative data, such as history of involvement in the criminal justice system and gross income. It has found the most important indicators to be prior receipt of public assistance and interactions with several mainstream County services, including Departments of Mental Health and Health Services, the Sheriff's Department, and Probation (von Wacther et al., 2019).

Although predictive models using public information are gaining in popularity, some argue that they minimize the importance of "private information" that people may possess about

their homelessness risk. O'Flaherty, Scutella, and Tseng (2018) argue that the context of reporting information matters, and the information in public domains may not be reliable. They suggest that information across private domains—private because it is idiosyncratic, subjective, or embarrassing, people may not report honestly, or programs cannot legally use it (e.g., race)—substantially increases the power of models that predict future homelessness. O'Flaherty and colleagues (2018) tested their theory using a longitudinal survey of people experiencing or at risk of homelessness in Australia and found evidence that in many cases "private" information predicts shelter entry better than public information. However, many of their strongest "private" predictors, including self-assessed current and past homelessness, crowding, and exposure to violence, are part of the data on which the Homebase model was developed.

New York City's Homebase program also uses an empirical predictive model to ensure that the families most at risk of homelessness receive the most services. The Risk Assessment Questionnaire (RAQ) was developed based on analysis of self-reported data on Homebase enrollees from 2004 to 2008 (Shinn et al., 2013), and includes several of the "private" predictors found to be strongest in O'Flaherty et al.'s work (e.g., past homelessness, which potentially includes that outside of the New York City shelter system, and therefore could not be fully verified in administrative records). Each item on the RAQ was chosen to identify those at most risk of homeless shelter entry over the subsequent 3 years. The RAQ asks questions about the household head's age, education level, employment status, and pregnancy status; their children's ages; public assistance receipt; their involvement with child protective services and various kinds of disruption they experienced in childhood; whether they have a rental lease, have recently been evicted by their landlord, or are experiencing discord with their landlord or household members; whether they recently applied for shelter or lived in a shelter as an adult; the number of times

they moved in the past year; and whether they had recently reintegrated into their community from being street homeless, in a homeless shelter, or in an institution. Answers to each question correspond to points ranging from one to three. These points are summed, resulting in a "score" ranging from zero to 25 assigned to each family (see Shinn et al., 2013 for a full description of the screener and Table 2 for details on items and scoring). Based on model results and program resources, the Homebase program delineated a cutoff score for service receipt, from a total possible score of 25: Those with a score of 7 or above would receive the full host of Homebase services ("full services") and those with a score below 7 would receive briefer Homebase services, typically consisting of only one or two visits with less in-depth support ("brief services"). Worker overrides of scores in service placements are permitted (with supervisor approval), reducing incentives for workers to misreport data to ensure eligibility. Generally, about three-quarters of families qualify for full services.

The current study

Though it is based on an empirical model, the predictive power of the Homebase RAQ model has not been examined since its development. Several contextual factors have changed: New York City's total population size has increased slightly (NYC Department of City Planning, 2020), its poverty rate has steadily decreased (NYC Mayor's Office for Economic Opportunity, 2020)—although poverty likely rose during the COVID-19 pandemic (Williams, 2021)—and City housing policies have been altered greatly. Changes in the policy context under the de Blasio Mayoral administration include the building of thousands of affordable housing units, rapid growth of the Homebase program (particularly to address the needs of Aftercare clients, whereas it previously focused on Prevention clients), and expansion of rental assistance programs, including a shift to City-funded programs (City of New York, de Blasio, & Glen,

2017). Indeed, authors of the original RAQ cautioned that statistical models are bound by time and place; they may not hold for other communities or later periods, particularly in the face of changes in patterns of outreach or the policy environment (Shinn et al., 2013). Thus, it is important to update and revise models over time. O'Flaherty and colleagues' (2018) view that models can be improved with additional information further supports the need for ongoing analyses to confirm the predictive power of models currently in use and potentially revise the items included. The current report re-evaluates the utility of the RAQ using data on a more recent cohort of families with children applying for Homebase services.

The study had several goals: first, to re-evaluate the predictive accuracy of the current Homebase risk assessment tool (the RAQ) in identifying families with children at elevated risk for subsequent application for homeless shelter, using a more recent cohort. We describe the accuracy for the total RAQ score cut-off and for each individual risk factor on the RAQ. Second, to examine whether worker overrides of scores for full-service eligibility improve predictions. Third, to explore whether, consistent with past research (Evans, et al., 2016; Greer, et al., 2016; Wood et al, 2008; Shinn et al., 2013), prevention services have the largest impact on shelter applications for those at highest risk. Fourth, to examine additional housing and substance use items that are not currently on the RAQ but are asked by all Homebase providers as part of the intake process. Finally, based on empirical findings as well as practice-based considerations raised by Homebase program leadership, the study proposes a revised, more predictively accurate RAQ, including proposed cut-offs for full service receipt. This study adds to the existing, but limited, literature on risk models in homelessness prevention. The analysis supports efforts to ensure that prevention services (both at Homebase and potentially in other homelessness prevention programs) are provided to those at greatest risk of future homelessness.

Methods

Sample

Our sample consists of all cases involving families with children who applied for Homebase services between January 1, 2013 and December 31, 2016. While most applicants are found eligible for services, there may be some informal prescreening that occurs when families clearly do not meet eligibility requirements; therefore, it is likely that not all interested families participate in a full application and assessment. Applicants were identified as families with children if their household included at least one adult and one child under age 18, or a pregnant person. Of the 49,345 unique families applying to Homebase, 83.1% (n=41,015) applied only once from 2013-2016. The number of Homebase cases increased dramatically in volume between 2013 and 2015 as the program expanded, from roughly 600 cases a month in 2013 to more than 1,500 cases a month in some 2015 months. In order to maximize statistical power, we included all families who had complete information on all RAQ items, including those not eligible for services; sensitivity tests confirmed that including those not eligible for services did not substantively change results, compared to excluding them. Only 1.7% of the families in our sample were missing information on any RAQ item.

We examined the sample in two ways. First, for analyses that examine trends annually, families are counted once for each year they enrolled with Homebase between 2013 and 2016 (a total of 58,674 family-years). For families that enrolled more than once within a calendar year, we used their first Homebase application that year. Second, when describing family sociodemographics, and in risk models examining the entire sample (to address concerns about overfitting the model given that some families reapply), we de-duplicated the sample to include only the first time a family enrolled at Homebase during the four-year study period, labeled their

"benchmark" enrollment (final deduplicated n, after also excluding those without a complete RAQ score=48,450).

Homebase applicants in the deduplicated sample were predominantly female (90.4%) and English-speaking (86.4%, with 12.6% Spanish-speaking and the remaining 1% other languages). The majority were non-Hispanic Black (46.9%) or Hispanic/Latinx (39.7%). Applicants' average age at Homebase visit was 37.8 years, and the majority were unmarried (85.4%). Very few were veterans (0.8%). Regarding shelter history, 22.6% (n=10,940) had stayed in a NYC Department of Homeless Services (DHS) shelter in the five-year period before their benchmark enrollment in Homebase, while 12.9% (n=6,256) were in shelter in the two-year period before their benchmark enrollment. Among those with a shelter stay, families had an average stay of 342 days in a DHS shelter over the five-year period and 266 days in a DHS shelter during the two-year period.

Measures

Sociodemographic data were obtained from DHS administrative records. RAQ item data and additional Homebase data were obtained from interviews with household heads conducted by Homebase staff and entered into DHS administrative records (see Table 1 for the list of items). Since the RAQ is a questionnaire, all responses are self-reported by household heads; responses were not fact-checked against administrative records. For example, respondents were asked whether they received public assistance, but we did not cross-check this against Department of Social Services administrative records on public assistance receipt. Data on DHS shelter applications within the two years after Homebase application (through December 31, 2018) and over the five years before Homebase application, as well as the number of days in shelter before Homebase application, were obtained from DHS administrative records. For a brief

supplementary analysis of reasons for overrides from full to brief services, we randomly selected 10 cases and reviewed their case notes in administrative records.

Our analysis differed from that used to develop the RAQ (Shinn et al., 2013) in that we modeled homeless shelter applications rather than homeless shelter entries, and over two years rather than three. To the extent that any of the RAQ items have a different association with a family's risk of applying to shelter compared to the association with their risk of actually entering shelter, our results will differ from Shinn et al.'s. We examined applications because we were most interested in potential need for shelter, and we set a two-year period because most shelter applications post-Homebase enrollment occur within this period. Also, the Homebase program aims to help families who might imminently lose their housing. Time to shelter application is therefore truncated at 730 days for families that did not apply to a homeless shelter during the outcome period (Type I right censoring).

Data analysis

We estimated a series of step-wise predictive models using survival analysis (Cox proportional hazards) to model the hazard of applying for shelter over the two years after applying for Homebase services for current and proposed RAQ cut-offs, as well as individual RAQ items. Analyses were conducted using Stata version 14 (StataCorp LP, College Station, TX). Survival analysis accounts for time to shelter application. The hazard ratios for each item are adjusted for all other variables in the model.

We estimated models with three sets of predictors. One model tests the current RAQ items as predictors, and a second model tests an additional set of housing and substance use indicators that are asked by all Homebase providers and were observed in practice by Homebase leadership and staff to be associated with risk of shelter application. The third model includes

only those indicators from the previous two models that were that were statistically significant after backwards stepwise regressions. Tables 1 and 2 show the full set of current RAQ items plus our additional housing and substance use items, all entered as predictor variables in our hazard models. All but two variables in the model are binary. The two conflict variables (conflict/problems with the landlord and conflict/problems with household members) are ordinal, ranging from "no problem" to "not much of a problem" to "kind of a big problem" to "a very big problem" with the landlord or household members. None of our variables are time varying. Although answers to the RAQ and Homebase intake questions could change across time for families who re-appeared, we selected for our models only the first Homebase application, as described above. In both sets of models, we eliminated nonsignificant variables via backwards regression and then verified that each remained nonsignificant when added back to the final model. As in previous studies of the RAQ (Shinn et al., 2013; Greer et al., 2016), we compared the efficiency of each of these step-wise models using receiver-operating characteristic (ROC) curves, here based on logistic regression models with all of the same predictors (as ROC curves are challenging to obtain from hazard models). ROC curves plot the "true positives" (correct predictions of applying for shelter among those who actually did apply for shelter) against "false positives" (false predictions of shelter application among those who did not apply for shelter), for all possible cutoffs of the scores in each model. The area under the curve (AUC) provides a general measure of model efficiency. We also obtained Harrell's concordance statistics for each hazard model, which provides a similar value to the AUC for survival models. Harrell's C provides the proportion of observations that the model can order correctly, in terms of survival times, comparing the predicted and observed outcomes. We further compared the fit of each model using Likelihood Ratio tests.

As a sensitivity check, we compared model results after removing Aftercare families, since they received specialized support to help them maintain their housing after exiting a homeless shelter. As another check, to explore the sensitivity of models to economic, housing, policy, or other changes that occurred throughout the analysis period, we ran our models separately by year of Homebase application, creating annual cohorts of Homebase applicants for 2013, 2014, 2015, and 2016 to see how the results varied across the study years; a family can appear in multiple cohorts if they enrolled with Homebase in multiple years.

Based on the findings of our step-wise models and sensitivity checks, we propose predictors for inclusion and exclusion in a revised RAQ. Following the recommendations of the forecasting literature (Dana & Dawes, 2004; Dawes & Corrigan, 1974) as well as the methodology utilized in previous studies of the RAQ (Greer et al., 2016; Shinn et al., 2013), we assigned integer weights to each predictor based on its hazard ratio. We created simulations to determine what impact these proposed RAQ changes would have on the number of clients who would be eligible for Homebase full services. We also examined the predictive power of a revised RAQ with a threshold that served a similar number of clients, and compared it to the predictive power of the current RAQ's threshold.

Results

Distribution of RAQ scores

Of the total 58,674 "family-year" applications from 2013 to 2016 included in our sample, 43,333 (73.9%) scored a 7 or above on the RAQ, the threshold for qualifying for full services. Percentages were similar across years, with a slight dip in 2014: 76.9% in 2013, 65.9% in 2014, 74.3% in 2015 and 77.8% in 2016.

Examining the distribution of total scores, we observe only small numbers of families with very low or very high scores. Trends show a marked change around the threshold for full services, jumping from 4,269 cases scoring 6 to 10,634 scoring 7 and dropping sharply to 7,756 cases scoring 8. This suggests that Homebase staff may be focused on getting families to that threshold so they qualify for full services. Additionally, low-scoring families may be self-selecting out of the sample, as families seeking financial assistance who do not qualify may not complete the intake process. If these families were present in the sample, we would likely see more scores below 7.

Predictive accuracy of the current RAQ

Exploring homeless shelter applications over the two-year period after families' benchmark Homebase enrollment, 11.7% of the 58,674 family-year cases (n=6,858) applied for shelter. Over twice as many families with scores of 7+ applied for shelter (13.7%, n= 5,950), compared to those with scores below 7 (5.9%, n=908; χ^2: 699.98, p<.001). Among those who applied to shelter, both groups applied to shelter on average twice after their Homebase enrollment, and the amount of time that elapsed between their benchmark Homebase enrollment and their first subsequent shelter application averaged approximately eight months for both (238 days for RAQ<7 and 250 days for RAQ 7+).

Examining the association between RAQ score and shelter application among those assigned to full or brief services (organizing scores into bins of 1,000 members or more; Figure 1), we found that as the RAQ score increases, rates of subsequent shelter application also rise. Note that in Figure 1 only, those without a case type and in a small (n<30) "advice only" group are removed from the sample, as the Figures compares trends between "brief" and "full" services. All other analyses examine trends regardless of service assignment. Taken together,

these findings indicate that the RAQ cutoff of 7 is continuing to identify high-risk families in need of Homebase services to prevent homelessness and suggest that Homebase is providing more services to those most at risk for homelessness.

------INSERT FIGURE 1 ABOUT HERE------

RAQ score, service assignment, and prediction of shelter application

While the RAQ score serves as a primary determinant for Homebase service eligibility, as seen in Figure 1, there are families who were assigned to full or brief services because of worker overrides instead of RAQ score. (As described above, Homebase staff are given the authority to override the RAQ score when deciding whether a family should qualify for full or brief services.) Except for those at a RAQ score of 0 to 2, families assigned to brief services are consistently more likely to apply to shelter than those assigned to full services, with the difference between the groups tending to increase as risk scores increase (though for unknown reasons, there is a flattening of this trend in the 10 to 11 and 15 to 25 score ranges). For example, at a RAQ score of 5, there is a 2.2 percentage point difference in shelter application rates between those assigned to full services and those assigned to brief services, while there is a 9.7 percentage point difference at a score of 8, and a 17.4 percentage point difference at a score of 13. These trends may indicate that full prevention services make the most difference for those at higher risk of becoming homeless. However, sample sizes are fairly small among those with high RAQ scores assigned to brief services (38 to 146 families at each RAQ score from 7 to 15-to-25) and in those with low RAQ scores assigned to full services (148 to 1,017 families at each RAQ score from 0-to-2 to 6); these trends should therefore be interpreted with caution. Moreover, when families are assigned to a level of service other than that indicated by their RAQ score, this could potentially skew the relationship between RAQ scores and later homeless shelter applications. We therefore

conducted additional analyses to explore outcomes for the override group and reasons why workers may have changed service categories.

Overall, a small fraction of the 58,674 family applications—6.1% (n=3,595)—were reclassified to full or brief services by Homebase staff: for 2,790 applications (4.8%), the family's RAQ score fell below 7 but their Homebase worker determined they should qualify for full Homebase services. In addition, 805 applications (1.4%) had a RAQ score above seven but were not assigned to full Homebase services.

In total, 3.7% (n=102) of the families who had an override from brief to full services applied to shelter, while 25.8% (n=208) of the families who had an override from full to brief services applied to shelter. This suggests that worker judgment is less accurate than the RAQ at predicting risk of homelessness on average: Families who received an override from brief to full services were not actually at very high risk, although their receipt of full Homebase services may have contributed to their low homeless shelter applications. Conversely, families with high RAQ scores with overrides from full to brief services were in fact at high risk. Decisions to refer a family with a high RAQ score for brief services were based on individual staff judgement and could therefore vary, but potential reasons were explored in our review of 10 randomly selected case notes. The review found that the majority of families with overrides from full to brief services needed an apartment quickly but had no funds or rental assistance available. As noted above, addressing this need is beyond Homebase's capacity. Other override cases required external referrals or "one shot deal" funding to cover rent (which can be easily processed by the City's Human Resources Administration staff outside of Homebase). Beyond the case note review, Homebase program leadership generally observed that some high-scoring families were put into brief status by staff when clients did not appear again after the first visit because they

had already applied for shelter. Overall, findings from our limited case note review imply that it may not be so much worker clinical impressions as client behaviors or scope of needs that drive many full-to-brief override decisions. More broadly, there may be ways in which the override groups differ systemically from the larger group whose eligibility is consistent with their RAQ score. Regardless of the reason for the override determination, the small number of overrides relative to the full sample suggests that these are unlikely to substantially bias results.

Shelter applications and individual predictors

The first three columns of Table 1 present descriptive statistics for each predictor on the RAQ by homeless shelter applications over two years, while Model 1 shows hazard ratios for the current RAQ predicting shelter applications. Each hazard ratio controls for all of the other predictors in the model. Considered individually (columns two and three), most of the current RAQ predictors occurred at a significantly higher rate among those applying to shelter, with the exception of the item on "return to residence" in the past 6 months after release from an institution and formal eviction; however, in hazard models controlling for other factors, formal evictions predicted homeless shelter applications. Consistent with the analysis that led to the initial RAQ development (Shinn et al., 2013), many housing-related items in the RAQ were highly associated with shelter application. Indeed, not being the tenant on record was the strongest predictor of applying for shelter. Those who were not the tenant on record had a 2.6 times higher likelihood of applying for shelter over the next two years.

Items pertaining to shelter history as an adult ("having applied to shelter in the three months before going to Homebase for help" and "having stayed in a shelter since age 18") were also highly predictive of shelter application in the two-year period following their Homebase enrollment. Having moved recently is predictive of shelter application as well; interestingly, the

hazard ratio is only slightly higher for having moved four or more times compared to compared to one to three times— a 47% higher risk and a 40% higher risk, respectively. We were not able to model the number of moves as a continuous variable to see the difference one more move could make in predicting shelter application, as this item is grouped into these categories on the RAQ (per findings from the original RAQ analysis (Shinn et al., 2013). For example, it may be that moving once in the past year is not associated with a higher risk of shelter entry, while moving twice is.

Other household characteristics from the current RAQ that were significantly associated with increased risk of homeless shelter application over two years include: younger head of case, current pregnancy, having a child under two years old, current protective services, child's foster care involvement, not having a high school diploma or GED, and current unemployment.

High conflict with the landlord or with household members is associated with applying for shelter. For landlord conflict, the hazard ratio indicates that each move from one level to the next adds a 5% higher risk (hazard ratio=1.05), so families with a "very big" problem with their landlord have a 15% higher risk of applying for shelter than those with "no" problem. Similarly, moving from one level to the next on the household conflict item adds a 9% higher risk (hazard ratio=1.09); families with a "very big" problem with household members have a 27% higher risk of applying to shelter than those with "no" problem. While these associations are statistically significant and substantial in magnitude when comparing high levels of conflict to no conflict, they do not suggest as strong a relationship with applying to a homeless shelter as other housing indicators in the RAQ. That said, the ordinal nature of these landlord and household conflict items makes them difficult to compare to the binary nature of the other indicators in our model. Cox proportional hazards models assume equal distances between categories in ordinal variables

(e.g., that the distance between having “no” problem and “not much” of a problem is the same as the distance between having “kind of” a big problem and a “very big” problem). This assumption likely does not hold true.

The association between childhood adversity indicators and homeless shelter application was also mixed. Some childhood adversity items (having moved a lot as a child and stayed in a shelter as a child) are not associated with applying to shelter in our results. Having ever received public assistance as a child is slightly associated with applying for shelter (its p value is <.10), and its effect size is small (a 5% higher risk of applying to shelter). Having been in foster care as a child and abused or assaulted as a child have moderate effect sizes of an 11% and 13% higher risk of applying for shelter. In stepwise models, we explored the addition of (a) an index with all five of the childhood adversity items summed, (b) the addition of foster care in childhood alone, and (c) the addition of all five items individually. Log likelihood ratio tests show that each of these models explain additional variation in shelter applications beyond Model 1.

When these three models are compared to each other, the model that includes all five items individually had the best model fit, although only being in foster care as a child and childhood abuse are significant at p<.05. Upon further analysis by year (not shown), the five childhood adversity items on the RAQ are inconsistent across the study years: Having stayed in a shelter or temporary housing as a child and having moved four or more times as a child were not statistically significant in any of the study years 2013 through 2016. Having been on public assistance or in foster care as a child were statistically significant only in 2013. Having been abused or assaulted as a child was significant in 2014 and 2015, but just missed the significance threshold for 2016. Note that given the sensitive nature of the childhood adversity questions,

heads of case may be reluctant to answer them in an initial screening conversation, potentially reducing the quality of these data.

The RAQ item for currently receiving public assistance (as self-reported by the head of case) was not predictive of shelter application. Finally, items for "returning to a residence" from an institution or from the streets or a homeless shelter were actually protective of shelter application: They are associated with a decreased risk of shelter application by 14% (institution) and 27% (street or homeless shelter). This protection may come from the fact that many of these families now receive housing subsidies and Aftercare. Consistent with this interpretation, when Aftercare cases were removed from the sample (not shown), we found no statistically significant relationship between these variables and shelter applications. Moreover, further analysis of data for the entire sample by year (not shown) finds that these items had no statistically significant association with shelter application (i.e., neither positive nor negative) in 2013, but had a negative association with shelter application in each of the subsequent years studied, after the new administration's rental assistance programs were launched.

------INSERT TABLE 1 ABOUT HERE------

RAQ revision

We then explored adding additional housing and substance use items to the RAQ, drawing from questions already asked by all Homebase providers as part of the intake process. The second section of Table 1 labeled "Indicators not Currently on the RAQ" and the column for Model 2 displays the set of housing and substance use indicators that we added to our survival models predicting shelter application. Almost half of families never had a lease or mortgage in their name; over a third appeared in housing court in the past year, while 14% reported that they lost public assistance, housing subsidies, or benefits in the past year. Fewer (1 to 2%) had lost a

Housing Choice Voucher or been evicted from New York City public housing. Regarding substance-use-related factors, we combined current and former substance use and current and former substance use treatment because only a very small number of families report current use or treatment. None of these items specify the type or class of substance. Even combined, only one to one-and-a-half percent self-reported current or past substance use or current or past treatment. As might be expected, there was a strong correlation between these two items (r=0.734) and a high overlap: 63.5% of those who reported current or former substance use also reported receiving treatment. The fact that some family heads reported receiving substance treatment but not using substances suggests that these self-reported substance items may not be high quality data. In fact, approximately one-third of the family enrollments are missing information for these housing and substance use indicators (35.1% for housing and 33.5% for substance use). Rather than excluding these substance use and treatment data altogether, we include them plus indicators for families who were missing this data in our survival models. All added predictors were more frequent among those applying to shelter (Table 1), except having appeared in housing court in the past year.

Model 2 in Table 1 adds these new housing and substance items. We see no substantive change to the results for the other RAQ items—the hazard ratios are of similar size and statistical significance. We find that having had and lost a Housing Choice Voucher is associated with a sizable 51% higher risk of applying to shelter in the two years following Homebase enrollment. Never having a lease or mortgage in the head of case's name also significantly predicts shelter application. Two of the additional housing items are associated with a more moderate 12 to 13% higher risk of shelter application: appearing in housing court in the past year, and losing any public assistance, housing subsidies, or benefits in the past year. Having been evicted from New

York City public housing is not associated with shelter application among our Homebase family cohort. Log-likelihood tests from step-wise models showed that a model with both having had and lost a Housing Choice voucher and never having had a lease or mortgage had a better fit than the models with each of these factors alone (not shown).

When entered together into the model, neither of the two substance use-related items were associated with homeless shelter application in the full sample. As there is high overlap between these items and therefore potential collinearity, we entered them separately in step-wise models (not shown). Here, substance use and treatment are each statistically significantly associated with time to shelter application (for substance use: $p<.01$ & hazard ratio=1.26; for substance treatment: $p=0.01$ & hazard ratio=1.30). When we examine these substance use items across the study years (not shown), we find that having received treatment is strongly and highly associated with shelter application in 2016, with a 245% higher risk that year. This compares to no statistically significant association for 2013, 2014, or 2015 Homebase enrollees, raising the question of whether there were policy or practice changes that would explain this shift. That said, this finding should be interpreted with caution because the number of heads of case who reported receiving treatment is low: 154 in 2013, 194 in 2014, 171 in 2015, and 110 in 2016. Note also that our two flags for missing information on these housing and substance use items are statistically significant. It is difficult to draw conclusions about these flags since we do not know why their information is missing.

We also tested our predictive models with the subset of Aftercare families removed to see if the relationship between our indicators of interest and homeless shelter application changed, since Aftercare families receive specialized support to maintain their housing subsidies after exiting a homeless shelter (not shown). The most noticeable change was that the magnitude of

three important housing items on the RAQ decreased moderately, although the items remain highly statistically significant: not being the tenant on record, had a formal eviction in the past three months, and had an informal eviction in the past three months. Moreover, as noted above, the protective effect of returning to one's residence from living on the street or in a shelter that we saw in 2014, 2015, and 2016 disappears. Overall, these findings imply that Aftercare cases do not substantially impact the predictive power of most items on the RAQ.

Model 3 in Table 1 is the final modified model, after eliminating nonsignificant variables via backwards regressions and then checking that each eliminated variable remained nonsignificant when added back into the final model (not shown). These analyses led us to remove items on current public assistance receipt, on returning to a residence from an institution or shelter, and most items on childhood experiences. Step-wise results also led us to add items about having lost a Housing Choice Voucher and never having a lease/mortgage. Because higher intensity on the categorical landlord and household member conflict items resulted in sizeable hazard ratios, our final model includes a binary indicator for having very severe problems (answering a "very big" problem) on the landlord and household member conflict items.

Other changes were informed by practical considerations. While being in foster care as a child and childhood abuse were both statistically significant in our models, Homebase leadership and staff have expressed concerns about asking Homebase clients sensitive questions about their childhood (particularly abuse) when they arrive at Homebase for housing help. Therefore, our final model includes only foster care on the RAQ (as this was seen as the least invasive and most fact-based of these two statistically significant adversity items) and removes the other four childhood adversity indicators. And while past or current substance use had a slightly higher predictive value than past or current treatment, their contributions to the model were similar and

program leadership thought that asking about treatment would be less invasive, less subjective, and potentially more honestly reported.

We then assigned each RAQ item 1 or 2 points, based on hazard ratio values over each year (see Appendix). We rounded up slightly to appropriately weight higher-risk items: Items that had a hazard ratio between 1.90 and 2.89 and were statistically significant at $p<.05$ in at least one study year were assigned 2 points, and items that had a statistically significant hazard ratio (at $p<.05$) between 1.12 and 1.61 were assigned 1 point. The added items tended to have high hazard ratios and significance levels in more recent years. We summed the points to create a new 20-item RAQ score with a possible range from 0 to 25 points (with higher scores indicating greater risks). Table 2 compares the content and scoring of the current and revised RAQs. There was a very strong correlation between the current and revised RAQs (r=0.973).

------INSERT TABLE 2 ABOUT HERE------

Scores on the revised RAQ for the families in our cohort ranged from zero to 19. Figure 2 shows the percentage of families who applied for shelter after their Homebase enrollment, for each revised RAQ score. The relationship is fairly linear, with each point increase leading to an increase in homeless shelter applications.

------INSERT FIGURE 2 ABOUT HERE------

Model efficiency is similar across models overall. As noted above, the ROC curves plot hit rates against false-alarm rates for both RAQ models at all levels of predicted risk. The revised model has an almost identical level of efficiency to the current model at both low and high levels of risk, and the ROC curves for both RAQ models were visually indistinguishable (see Appendix). The current model had an AUC of 0.7387 (CI=0.73–0.75), and the revised model had an AUC of 0.7389 (CI=0.73–0.75). Moreover, AUC values were similar for all of the stepwise

models that we ran to create the final revised model (varying from 0.736 to 0.743; not shown). AUC values between 0.7 and 0.9 indicate moderate discriminatory power of a model (Grzybowski & Younger, 1997). Harrell's C values for each survival model were also very similar in all step-wise models (all 0.72 or 0.73, not shown), including for the three models shown in Table 1. Likelihood ratio tests found that the models with all additional Homebase items and with the additional items selected for the final revised model each have a better fit than the current model (Table 1).

We then created an alternative threshold simulation to determine what impact these proposed RAQ changes would have on the number of clients who would be eligible for Homebase full services. A revised RAQ score with a threshold of five or higher would result in roughly the same number of family enrollments as the current RAQ and its threshold of seven or higher between 2013 and 2016 (Table 3). Using the altered final RAQ with an eligibility threshold of five yields a modest improvement to the precision rate over the current RAQ, bringing it to 15.2% (compared to 13.7% in the current RAQ with a cut-off of 7 (Table 3). Among those who score below a five on our revised RAQ, only 4.4% applied for shelter. The revised RAQ cut-off also slightly improves the sensitivity rate, by qualifying 87.6% of those who ultimately applied to shelter for full services (of the 6,858 family-enrollments that later applied for shelter, 6,009 qualified for full services with a 5+ on our revised RAQ), compared to 86.8% in the current RAQ with a 7+ score. When we regressed these binary service thresholds onto the shelter application rate in Cox proportional hazards survival models, we also found that families above the 5+ cut-off had a higher risk of applying to shelter than those above the 7+ cut-off on the current RAQ (3.8 vs. 2.5 times higher than those below the cut-offs), further indicating improved predictive power of the revised RAQ (Table 3).

------INSERT TABLE 3 ABOUT HERE------

Finally, we explored the stability of risk factors by examining how many families would be changed from brief to full services (or vice-versa) in the current vs. revised RAQ. For these analyses, we used 58,674 total family-enrollments across our four-year study period, rather than a deduplicated number of families. Of the 43,333 enrollments eligible for full services on the current RAQ, 81.7% (n=35,395) remained eligible for full services on the revised RAQ, while 18.3% (n=7,938; 13.53% of the entire sample) would be converted to brief services under the revised RAQ (based solely on score; note that this does not take staff overrides into account). An additional 4,150 families (7.1% of the entire sample) would be converted from brief services under the current RAQ to full services under the revised RAQ. The risk scores are therefore fairly stable across the new and revised RAQs.

Discussion

We found that the current risk assessment utilized by New York City's Homebase homelessness prevention program, developed in 2013, has generally maintained its predictive power over time, even with a change in criterion from homeless shelter entry (over three years) to homeless shelter application (over two years): The current RAQ cutoff of 7 for full services identifies families at higher risk of shelter application over two years in this new cohort. Consistent with the analysis that led to the initial RAQ development (Shinn et al., 2013), most individual RAQ items are also predictive of shelter application, including not being the tenant on record, receiving an eviction, having a shelter stay since age 18, having a shelter stay in the past three months, younger age of the head of case, the head of case being pregnant, and having a child under two in the household. Several of these factors, such as not having one's own lease and facing eviction, align with predictive models for single adults in New York City (Greer et al., 2016) and for adults and

families in Alameda County, California (Greer, 2014). Past homelessness is a predictor that also aligns with models in families exiting emergency shelter in 12 communities across the U.S. (Glendening & Shinn, 2017) and for single adults using emergency services (Doran et al., under review). Factors related to young families align with other research in New York City on risk factors for shelter entry (Shinn et al., 1998) and shelter return (Lin & Smith, 2004). These findings imply that Homebase is providing full services to the families most in need of them.

The authors of the initial RAQ analysis noted that statistical models depend on a stable state for prediction, and posited that their original model might not remain as predictive in the future, especially as the communities served, the nature and strategies for outreach, and City and State policies were altered (Shinn et al., 2013). While policies have indeed changed substantially in New York City since the original RAQ was developed, particularly around the expansion of rental assistance programs and increased outreach to Aftercare clients (i.e., those exiting homeless shelters) at Homebase (City of New York et al., 2017), the model has remained robust. It is especially noteworthy that although the RAQ was developed when Homebase served primarily Prevention clients, it maintains its predictive power with Aftercare clients (as well as in exploratory analyses without Aftercare clients included) in this more recent sample. One change from the original sample (Shinn et al., 2013) is that our sample has a smaller proportion who are not tenants of record and larger proportion facing formal evictions. This shift is likely related to the expanded Aftercare population served by Homebase.

At the same time, some of the predictors in the original model (most childhood adversity items, current receipt of public assistance, and return to community items) were not associated with applying to shelter over two years in this follow-up analysis, and higher levels of conflict with the landlord or household members had a stronger association with homeless shelter

application than lower levels of conflict. Further, additional analyses revealed that some items currently asked by program staff but not included in the RAQ (ever having had and lost a Housing Choice Voucher, never having had a lease or mortgage, and past or current substance use or treatment) were associated with increased risk of homeless shelter application and could be added to the Homebase risk assessment. A revised RAQ that accounted for these trends, taking into account both empirical and practice-based considerations, was found to have a slightly improved hit rate and false alarm rate as compared to the current model for shelter applications over two years. Specifically, utilizing a new cut-off of five in the revised RAQ qualified a similar number of families for full services, while yielding a modest improvement to the precision and the sensitivity rates over the current RAQ, and an improved hazard ratio predicting homeless shelter application. Risk scores were also fairly stable across the new and revised RAQs, with 82% eligible for full services using original and revised cut-offs.

We were also able to explore the predictive accuracy of worker overrides. Allowing for overrides makes standardized risk assessment more acceptable to staff and allows for application of practice wisdom by program staff. The accumulation of families who just met the current risk threshold suggests that even with the availability of overrides, workers may assist families in attaining a score that triggers full services. Without overrides, this pattern would likely be stronger. Nevertheless, we found that the current RAQ has better predictive power than staff overrides, and staff do not appear to be identifying many families who have a low RAQ score but a high risk for homeless shelter application. Our brief case note review indicated that many of the overrides from full to brief services may have been based on client needs that were beyond the scope of Homebase (e.g., an emergency housing need) or were due to client behavior (e.g., non-returns after a first Homebase visit), rather than failures in the risk assessment. Future

research could examine the timing and reasons for overrides in order to better understand their function in practice. For the time being, we recommend the continued use of overrides, but suggest that supervisors either consider limiting the number of overrides permitted, or train staff on the circumstances in which overrides are and are not appropriate. New tracking categories of "lost to follow up" or "need beyond program scope" may be more appropriate than a RAQ score override, in some cases.

We did find some preliminary evidence that, consistent with past research (Evans, et al., 2016; Greer, et al., 2016; Shinn et al., 2013; Wood et al, 2008), prevention services make the most difference for those at highest risk, though although this finding should be interpreted with caution because our analysis includes worker overrides, which allow staff to place a family with a RAQ score above 7 into brief services. (That is, a worker override from full to brief services is the only way that a high-risk household would fail to receive full services.) As in current practice, providing services to families with higher risk levels is likely the most efficient service provision approach. With the exception of overrides, Homebase provides full services to all applicants who qualify based on the risk assessment, so no counterfactual group of high-risk families who did not receive services is available.

This study has several limitations, many of which also apply to previous analyses used to develop both family and single adult versions of the RAQ (Greer et al., 2016; Shinn et al., 2013). First, both our work and previous analyses utilized a sample from a single program in a single large city in the Northeast U.S. New York City has a right to shelter, unlike most localities in the U.S., with high rates of rent burden and lack of affordable housing (City of New York et al., 2017; Coalition for the Homeless, 2020; NYU Furman Center, 2020); all of these factors impact homeless shelter application rates. Even within New York City, individuals who apply to

Homebase are not a random sample of housing-insecure New Yorkers, and application rates may vary based on neighborhood or outreach strategies used. Though our analyses found that most RAQ predictors were consistent over time, we were testing our models in the same geographic location and program. There is a need to validate the RAQ in other localities and with other populations in need of homelessness prevention services to inform national approaches. In New York City, the predictive validity of the model may continue to vary as policies, outreach strategies, and populations change. It remains important to continue to test, and potentially revise, these models in the future.

Second, some of the data on the RAQ are based on self-report and are not verifiable, and may be biased or inaccurate. This may be particularly true of more sensitive items, such as on substance use. The low level of missing data on the current RAQ, and our efforts to account for missing data on housing and substance use predictors in our revised models, address this issue somewhat, but not fully. Moreover, many of the RAQ questions, such as shelter history, eviction history, and head of case and children's age, are verified by documentation and/or other administrative records. Third, some key contextual data was unavailable, such as the reasons for and timing of worker overrides of the risk assessment score. This is an intrinsic limitation of utilizing administrative data for analysis. Fourth, although both the existing and newly explored RAQ items were based on prior research (e.g., Shinn et al., 2013; Shinn et al., 1998; Bassuk et al., 1997) and covered a range of domains, omitted variable bias is likely. Data on the timing of substance use treatment would have been useful, for example, as would better data on risk factors identified in literature that were not measured, such as doubling up with family or friends or high rent arrears or other debts (Greer, 2014; Shinn et al., 2013; Shinn & Khadduri, 2020). If families who complete the RAQ were not already restricted by income (200% of the poverty

line), income would almost surely be a predictor. Moreover, results may have differed if informal prescreening did not occur and all interested families completed an application and assessment (even when they are clearly ineligible based on income or other criteria).

Data on neighborhood disadvantage could potentially be added to the RAQ (if sufficient geographic data could be obtained; it is not currently consistently available on all Homebase applicants). Culhane, Lee, and Wachter (1996) showed that in both New York and Philadelphia, people who entered homeless shelters tended to come disproportionately from a small number of neighborhoods; and the Urban Institute has developed an index that estimates need for rental assistance at the level of census tracts (Urban Institute, 2021). More generally, it is possible that including more items would increase the RAQ's predictive power, though this must be balanced with the need for an assessment that is not burdensome on staff or clients.

Our findings have several implications for practice in New York City's Homebase program. Though the current RAQ was found to be robust and still has good predictive power, the revised RAQ would provide some improvement, both empirically and practically. We therefore recommend use of the revised RAQ with families at Homebase; the program is evaluating implications of such a shift for its systems and operations. The program will also consider the potential for any biased or disparate RAQ scoring outcomes for the populations served by Homebase before implementation of a revised RAQ occurs.

Our findings also have implications for homelessness prevention services more broadly and in other jurisdictions. Many homeless prevention programs may base decisions on who to enroll either solely on clinical judgement or on internally developed assessments whose predictive power has not been tested. Whether our model would have utility in other settings remains to be seen; key factors likely vary based on the population served; the availability of

housing, substance use, and mental health services; and other local policies impacting housing stability. As in the initial report on the RAQ (Shinn et al., 2013), we advocate use of our approach rather than our model; other programs could develop similar models based on factors that staff observe as important predictors, as well as the research literature. The New York City Homebase RAQ may be a useful start, however, and other homelessness prevention programs could test the predictive power of our revised risk assessment model, once instituted, in their work.

Conclusion

The RAQ risk assessment tool utilized by New York City's Homebase homelessness prevention program is effective in identifying families at elevated risk of homeless shelter application. A revised RAQ that removes items no longer significantly predictive of shelter application, adds new items not currently on the RAQ, and adjusts for practice considerations shows improved efficiency and predictive power compared to the current model. Homelessness prevention services in other jurisdictions could utilize a similar strategy to improve the efficiency of their services and ensure that they are helping those who are most at risk of homelessness. Further areas for potential analysis include examining the predictive value of other indicators that are or could be collected by Homebase, more fully exploring the reasons for and utility of worker overrides, and assessing the association between the RAQ items and eligible homeless shelter entry (vs. application).

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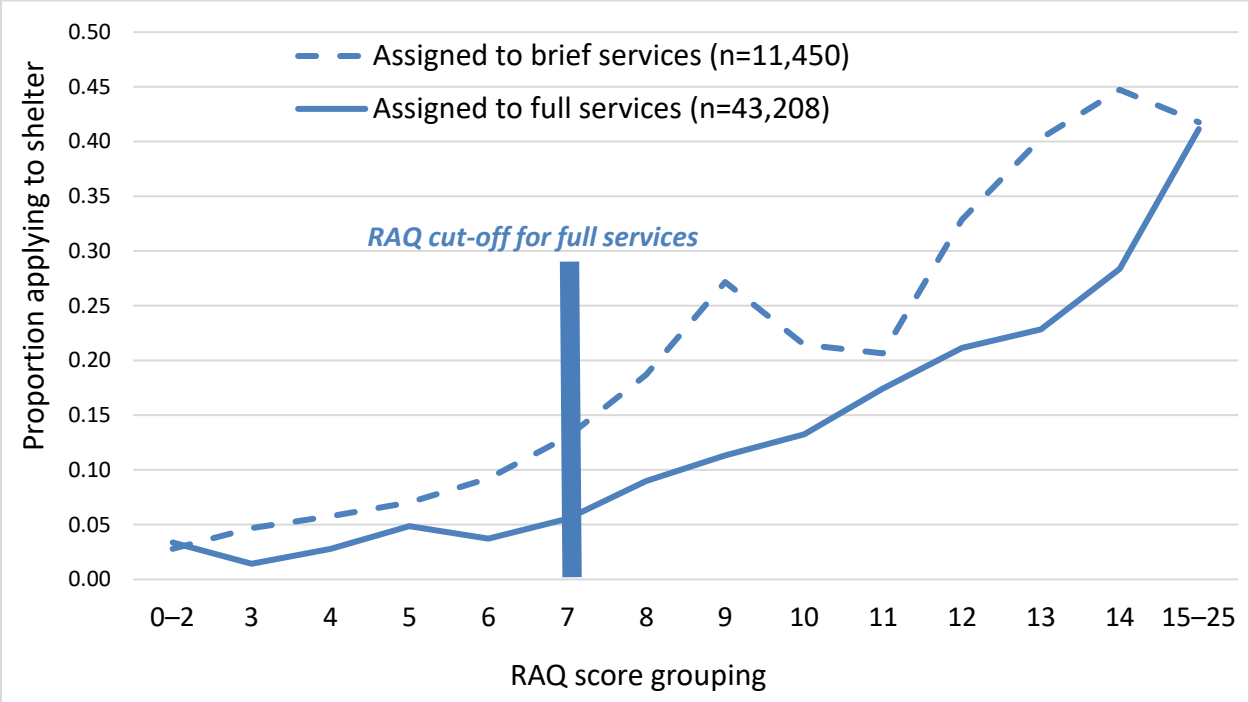
Figure 1. Proportion of families applying to a homeless shelter within two years after Homebase enrollment, by RAQ score and Homebase full services assignment



Notes: N=54,658 family-years. Families who enrolled with Homebase more than once per year between 2013 and 2016 are counted each year they enrolled (using information from their first enrollment that year). Excludes cases assigned to "advice" or without a case type listed. Also excludes cases who had missing values for RAQ items. We combined RAQ scores at the bottom and top of the distribution (0 to 2, and 15 to 25) to ensure a minimum of 1,000 families in each RAQ score grouping.

Table 1. Descriptive statistics and hazard ratios from survival models predicting DHS shelter application over 2 years, unique Homebase heads of family cases 2013–2016.

Indicators Currently on the RAQ:	No Shelter Application, n (%) (n=42,680)	Shelter Application, n (%) (n=5,770)	Shelter Application Rate	Model 1: Current Model Hazard Ratio (95% CI)	Model 2: Current Model and All New Items Hazard Ratio (95% CI)	Model 3: Revised Model Hazard Ratio (95% CI)
Socio-demographic items:						
Age 18 to 22 (vs. age 29 or older)	978 (2.3)	421 (7.3)	30.1	1.85*** (1.66-2.06)	1.80*** (1.61-2.01)	1.82*** (1.63-2.03)
Age 23 to 28 (vs. age 29 or older)	6,724 (15.8)	1,499 (26.0)	18.2	1.35*** (1.27-1.44)	1.34*** (1.26-1.43)	1.35*** (1.26-1.44)
Does not have a HS diploma or G.E.D.	17,131 (40.1)	2,483 (43.0)	12.7	1.10*** (1.04-1.16)	1.10*** (1.04-1.16)	1.10*** (1.04-1.16)
Not currently employed	23,620 (55.3)	3,628 (62.9)	13.3	1.22*** (1.15-1.29)	1.22*** (1.15-1.29)	1.23*** (1.17-1.30)
Currently receiving public assistance	23,493 (55.0)	3,320 (57.5)	12.4	1.03 (0.97-1.09)	1.03 (0.97-1.09)	
Child-related items:						
Currently pregnant	1,950 (4.6)	459 (7.8)	19.1	1.24*** (1.12-1.37)	1.23*** (1.12-1.36)	1.24*** (1.13-1.37)
Have co-resident children	41,099 (96.3)	5,546 (96.1)	11.9	1.07 (0.93-1.23)	1.08 (0.94-1.24)	1.09 (0.95-1.25)
Youngest co-resident child is under two years old	6,994 (16.4)	1,343 (23.2)	16.1	1.23*** (1.15-1.31)	1.23*** (1.15-1.31)	1.21*** (1.14-1.29)
Have an active ACS case (protective services)	5,298 (12.4)	1,092 (18.9)	17.1	1.33*** (1.24-1.43)	1.31*** (1.22-1.40)	1.32*** (1.23-1.41)
Any children have been placed in foster care	1,472 (3.5)	318 (5.5)	17.8	1.17** (1.04-1.32)	1.15* (1.02-1.29)	1.17* (1.04-1.31)
Return to residence items:						
Returned to a residence in past 6 months after release from an institution	3,015 (7.1)	346 (6.0)	10.3	0.86** (0.77-0.96)	0.86** (0.77-0.96)	

Returned to a residence in past 6 months after living on the street or in a shelter	2,575 (6.0)	617 (10.7)	19.3	0.73*** (0.66-0.80)	0.73*** (0.66-0.80)	
Housing items:						
Not the tenant on record (i.e., no lease)	5,437 (12.7)	2,094 (36.3)	27.8	2.59*** (2.42-2.77)	2.40*** (2.24-2.58)	2.46*** (2.30-2.64)
Formal eviction: Received a written eviction notice from landlord in past 3 months	28,816 (67.5)	3,368 (58.4)	10.5	1.45*** (1.36-1.56)	1.42*** (1.32-1.53)	1.56*** (1.46-1.67)
Informal eviction: Landlord or leaseholder asked you to move out in past 3 months	7,977 (18.7)	1,790 (31.0)	18.3	1.41*** (1.31-1.51)	1.41*** (1.31-1.50)	1.47*** (1.38-1.58)
Applied to shelter in past 3 months because of housing issues	1,796 (4.2)	875 (15.2)	32.8	1.92*** (1.76-2.06)	1.91*** (1.76-2.08)	1.73*** (1.60-1.88)
Since age 18, ever stayed in a shelter because of housing issues	18,326 (42.9)	3,767 (65.3)	17.1	2.20*** (2.08-2.33)	2.21*** (2.08-2.34)	2.20*** (2.07-2.32)
Moved 1 to 3 times in the past year (vs. no moves)	7,231 (16.9)	1,832 (31.8)	20.2	1.40*** (1.31-1.50)	1.41*** (1.32-1.51)	1.34*** (1.26-1.43)
Moved 4 or more times in the past year (vs. no moves)	389 (0.9)	205 (3.6)	34.5	1.47*** (1.26-1.72)	1.47*** (1.26-1.71)	1.36*** (1.17-1.59)
Conflict or problems with landlord [a]				1.05*** (1.03-1.07)	1.06*** (1.04-1.08)	1.18*** (1.11-1.25)
0=No problem	19,625 (46.0)	2,680 (46.5)	12.0			
1=Not much of a problem	5,311 (12.4)	572 (9.9)	9.7			
2=Kind of a big problem	6,583 (15.4)	834 (14.5)	11.2			
3=Very big problem	11,161 (26.2)	1,684 (29.2)	13.1			
Conflict or problems with others in household [a]				1.09*** (1.06-1.12)	1.09** (1.06-1.12)	1.26*** (1.17-1.37)
0=No problem	35,202 (82.5)	4,170 (72.3)	10.6			
1=Not much of a problem	2,226 (5.2)	312 (5.4)	12.3			
2=Kind of a big problem	1,865 (4.4)	414 (7.2)	18.2			
3=Very big problem	3,386 (7.9)	874 (15.2)	20.5			
Childhood adversity items:						
In foster care as a minor child	3,269 (7.7)	688 (11.9)	17.4	1.11* (1.02-1.21)	1.11* (1.02-1.21)	1.17*** (1.08-1.27)
Stayed in a homeless shelter or temporary housing as a minor child	5,100 (12.0)	1,018 (17.6)	16.6	1.03 (0.96-1.11)	1.04 (0.96-1.12)	

Ever physically, emotionally, or sexually abused or assaulted as a minor child	7,548 (17.7)	1,331 (23.1)	15.0	1.13*** (1.05-1.20)	1.12*** (1.05-1.20)	
Family ever received public assistance as a minor child	20,195 (47.3)	3,146 (54.5)	13.5	1.05^ (0.99-1.11)	1.04 (0.99-1.10)	
Moved to a new home/residence/housing situation more than 4 times as a minor child	11,582 (27.1)	1,823 (31.6)	13.6	0.97 (0.92- 1.04)	0.98 (0.92-1.04)	
Indicators not Currently on the RAQ:						
Housing items not on the RAQ:						
	16,403 (38.4)	1,860 (32.2)	10.2		1.13** (1.04-1.23)	
Had and lost a Housing Choice Voucher	798 (1.9)	183 (3.2)	18.7		1.51*** (1.29-1.75)	1.53*** (1.31-1.77)
Ever evicted from NYC public housing	225 (0.5)	44 (0.8)	16.4		0.99 (0.73-1.34)	
Never had a lease or mortgage in your name	18,867 (44.2)	3,254 (56.4)	14.7		1.34*** (1.23-1.46)	1.26*** (1.16-1.37)
Lost any public assistance, housing subsidies, or benefits in past year	5,970 (14.0)	911 (15.8)	13.2		1.12** (1.04-1.21)	
Missing information on new housing items	--	--	--	--	1.11* (1.01-1.22)	1.05 (0.96-1.15)
Substance use items not on the RAQ:						
Currently using or formerly used substances	584 (1.4)	144 (2.5)	19.8		1.12 (0.87-1.45)	
Currently receiving or formerly received drug/alcohol treatment	435 (1.02)	105 (1.82)	19.4		1.14 (0.85-1.53)	1.30** (1.07-1.58)
Missing information on substance use	--	--	--	--	0.93^ (0.86-1.01)	0.93^ (0.86-1.02)
Likelihood Ratio test Chi-square value (compared to Model 1)					110.70***	91.42*** [b]
Harrell's C concordance statistic				0.73	0.73	0.73

Notes: N=48,450 unique heads of case who enrolled with Homebase at least once between 2013 and 2016. Families who enrolled with Homebase more than once per year between 2013 and 2016 are counted the first time they enrolled during this four-year period. Excludes families who had missing values for RAQ items. All information is self-reported at Homebase. PA=public assistance. HB=Homebase.

[a] These two items are modeled as ordinal variables ranging from 0 to 3 for Models 1 and 2, but are binary ("very big problem" vs. all other values) in Model 3; all other items are binary 0/1 variables in all models.

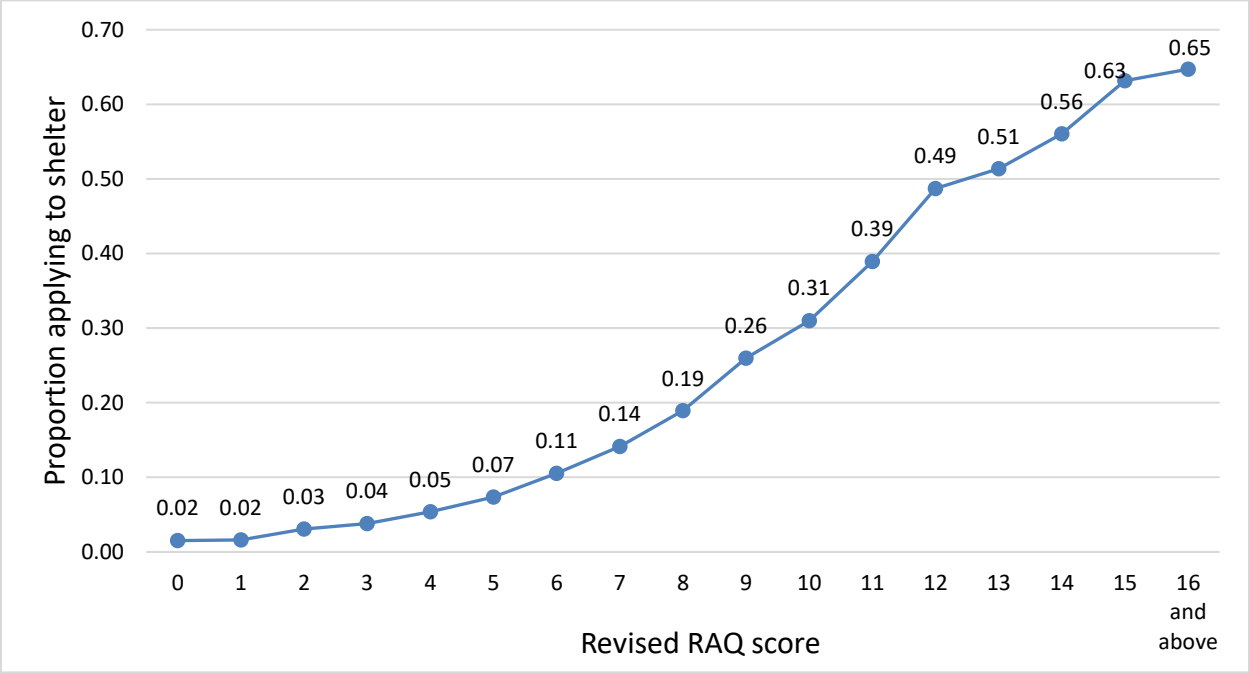
[b] For the Likelihood Ratio test comparing Model 1 and Model 3, Model 3 adds the new items that are in the final model but does not remove any items, since this test assumes that the comparison model (Model 1) is "nested" within the new model.

^p ≤ 0.10 *p ≤ 0.05 ** p ≤ 0.01 ***p ≤ 0.001

Table 2. Items and scoring in revised RAQ model, compared to current RAQ model.

Current Version Points	Revised Version Points	Risk Factor
No changes between current and revised versions:		
1	1	Currently pregnant
1	1	Child under two years old
1	1	No high school diploma or a GED
1	1	No current employment
1 or 2	1 or 2	Age: 1 point if 23 to 28 years old, 2 points if 22 or under
2	2	Applied to homeless shelter within past 3 months
2	2	Eviction notice (formal or informal) within past 90 days
Scoring changes (no change in items):		
1	2	Not the tenant on record
3	2	Stayed in a homeless shelter in New York City since the age of 18
2	1 or 2	Child protective services involvement item: *Current version:* Ever had active child protective services case or had a child placed in foster care (2 points if either was true) *Revised version:* 1 point if ever had an active child protective services case, 1 point if ever had a child placed in foster care, 2 points if both
1 or 2	1	Moves in past year: *Current version:* 1 point if moved 1 to 3 times, 2 points if moved 4 or more times *Revised version:* 1 point if moved 1 or more times
1 or 2	1 or 2	Conflict or problems with landlord or household members items: *Current version:* with landlord or with household members. (1 if moderate conflict for either, 2 if severe conflict for either) *Revised version:* 1 point if conflict is a "very big" problem with landlord, 1 point if conflict is a "very big" problem with household members, 2 points if both
Content changes:		
1 or 2	1	Childhood adversity items: *Current version:* foster care, shelter, abused or assaulted, family received public assistance, family moved more than 4 times (1 point if 1 to 2 experiences, 2 points if 3 or more) *Revised version:* 1 point if ever in foster care as a minor child; other items removed.
1	N/A (removed)	Return to residence items: In the past six months, released from prison, hospital, mental health facility, or substance abuse treatment facility; or living on the street or in a homeless shelter
2	N/A (removed)	Currently receiving public assistance
N/A (new item)	2	Currently receiving or formerly received any drug or alcohol treatment (2 points if either)
N/A (new item)	2	Ever had and lost a Housing Choice Voucher
N/A (new item)	1	Never had a lease or mortgage
Total points possible: 25	*Total points possible: 25*	

Figure 2. Proportion of families applying to a homeless shelter within two years after Homebase enrollment, by revised RAQ score.



Notes: N=58,674 family-years. Families who enrolled with Homebase more than once per year between 2013 and 2016 are counted each year they enrolled (using information from their first enrollment that year). Excludes families who had missing values for RAQ items.
Scores above 16 are grouped due to small n's

Table 3. Comparison of current and revised service thresholds: Observed shelter application rate and hazard ratios.

	Current RAQ		Revised RAQ	
	≤6	7+	≤4	5+
Number of family-enrollments between 2013 and 2016 §	15,341	43,333	19,129	39,545
Percent of analysis sample	26.1	73.9	32.6	67.4
Number applied for shelter in 2 years following Homebase enrollment	908	5,950	849	6,009
Percent applied to shelter in 2 years following Homebase enrollment	5.9	13.7	4.4	15.2
Survival model hazard ratio predicting shelter application ‡		2.5		3.8

§ N=58,674 family-years. Families who enrolled with Homebase more than once per year between 2013 and 2016 are counted each year they enrolled (using information from their first enrollment that year). Excludes families who had missing values for RAQ items. All information is self-reported at Homebase.

‡ N=48,450 unique heads of case who enrolled with Homebase at least once between 2013 and 2016. Families who enrolled with Homebase more than once per year between 2013 and 2016 are counted the first time they enrolled during this four-year period. Excludes families who had missing values for RAQ items.

ONLINE APPENDIX TABLES AND FIGURES

Table A1. Hazard Ratios (HRs) for revised model—by study year, including Homebase heads of family cases with multiple applications, 2013–2016.

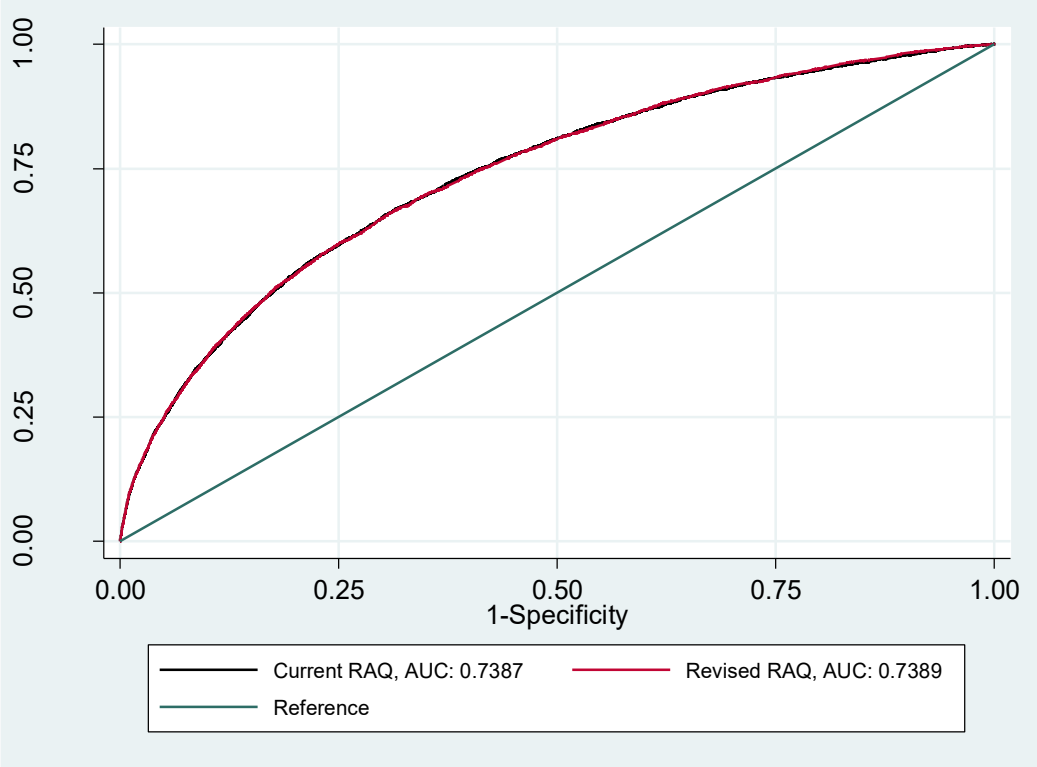
Indicators Currently on the RAQ:	2013 n=9,541	2014 n=13,090	2015 n=19,129	2016 n=16,914	*Points Assigned (based on HR)*
Socio-demographic items:					
Age 18 to 22 (vs. age 29 or older)	1.67***	2.17***	1.98***	1.60***	*2*
Age 23 to 28 (vs. age 29 or older)	1.20*	1.31***	1.27***	1.43***	*1*
Does not have a HS diploma or G.E.D.	1.10^	1.12*	1.04	1.12*	*1*
Not currently employed	1.25***	1.18**	1.29***	1.25***	*1*
Child-related items:					
Currently pregnant	1.31*	1.10	1.21*	1.24*	*1*
Have co-resident children	0.97	1.32^	1.18	1.08	*N/A*
Youngest co-resident child is under two years old	1.26**	1.13^	1.16**	1.21***	*1*
Have an active ACS case (protective services)	1.38***	1.20**	1.24***	1.36***	*1*
Any children have been placed in foster care	1.10	1.13	1.46***	0.96	*1*
Housing-related items:					
Not the tenant on record (i.e., no lease)	1.79***	2.62***	2.81***	2.35***	*2*
Formal eviction: Received a written eviction notice from landlord in past 3 months	1.10	1.70***	1.94***	1.49***	*2*
Informal eviction: Landlord or leaseholder asked you to move out in past 3 months	1.03	1.70***	2.06***	1.40***	*2*
Applied to shelter in past 3 months because of housing issues	1.90***	1.84***	1.76***	1.56***	*2*
Since age 18, ever stayed in a shelter because of housing issues	2.79***	2.24***	2.15***	2.06***	*2*
Moved 1 to 3 times in the past year (vs. no moves)	1.37***	1.27***	1.28***	1.50***	*1*
Moved 4 or more times in the past year (vs. no moves)	1.40^	1.18	1.27^	1.61***	*1*
"Very big" problem with landlord (vs. "no problem" to "kind of a big problem")	1.31***	1.13^	1.21***	1.18***	*1*
"Very big" conflict or problem with others in household (vs. "no problem" to "kind of a big problem")	1.20^	1.24*	1.13^	1.40***	*1*
Childhood adversity item:					
In foster care as a minor child	1.25*	1.05	1.11	1.14^	*1*

Indicators Added to the RAQ:					
Housing items added to the RAQ:					
Had and lost a Housing Choice Voucher	1.13	1.50**	1.38*	2.02***	*2*
Never had a lease or mortgage in your name	1.15	1.08	1.32***	1.42***	*1*
Missing information on new housing items	1.18	1.19^	1.13	0.95	*N/A*
Substance use items added to the RAQ:					
Currently receiving or formerly received drug/alcohol treatment	0.99	1.23	1.44*	2.01***	*2*
Missing information on substance use	0.97	0.96	0.87*	1.00	*N/A*

Notes: N=58,674 family-years. Families who enrolled with Homebase more than once per year between 2013 and 2016 appear each year they enrolled. Excludes families who had missing values for RAQ items. All information is self-reported at Homebase.

^p ≤ 0.10 *p ≤ 0.05 ** p ≤ 0.01 ***p ≤ 0.001.

Figure A1. ROC curves for model efficiency, current and revised RAQ models.



Notes: N=48,450 unique heads of case who enrolled with Homebase at least once between 2013 and 2016. Families who enrolled with Homebase more than once per year between 2013 and 2016 are counted the first time they enrolled during this four-year period. Excludes families who had missing values for RAQ items. All information is self-reported at Homebase.