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Progress in Preventive Health Care in New York City, 2002 to 2011

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ABSTRACT

OBJECTIVES

To track the use of preventive health care services in New York City (NYC) over the time period 2002 to 2011, and to document any disparities that may exist in both the use of such services across subpopulations as well as the rate of change in that usage.

METHODS

Annual population surveys of probability samples of NYC adults collected data from 93,125 adult residents of NYC between 2002 and 2011. Seven widely-recommended preventive health services were monitored over this time period including: having a primary care physician; always receiving needed medical care; cholesterol testing; flu vaccinations; and colonoscopy, mammogram, and pap smear screenings.

RESULTS

Positive and statistically significant linear trends over time were found for use of 5 of the 7 preventive health services. The exceptions were: cholesterol testing and “always receiving needed care.” Among subpopulations, Whites and the more educated New Yorkers reported greater utilization of most preventive health care services while substantially lower rates were reported by the uninsured and poorer segments of the population. Surprisingly, there was a higher rate of reported pap smear and mammogram screening among Black and Hispanic women compared to White women, and no linear association could be detected between education level and mammogram screening.

CONCLUSION

Substantial but not universal progress was made between 2002 and 2011 in the adoption of recommended preventive health care services by New York City adults.

INTRODUCTION

New York City's health care system faces the unique challenge of serving not only the most populous city in the United States but also a city with one of the most racially and ethnically diverse populations[1]. In the time period 2008 to 2012, 36.9% of New York City residents were foreign born; http://quickfacts.census.gov/qfd/states/36/3651000.htm1, *accessed August 6, 2014.*

Baseline data for New York City and evidence from elsewhere document substantial disparities in access to and use of health care by the poor and racial and ethnic minorities[2] [3]. While health care encompasses a broad range of services, certain basic and preventive care services are recommended for substantial segments of the adult population. These include: having a primary physician, cancer screenings, and vaccinations. Such services are underutilized due to economic, structural, cultural and personal barriers to care[4].

In the present study, we will assess trends over time and disparities in the use of these basic preventive care services by subpopulations (defined by race, ethnicity and socioeconomic status) of New York City residents from 2002 through 2011. Our analyses will seek to answer three interrelated questions:

- Has the use of these basic preventive services *increased over time* in New York City, and, if so, at what rate?

- Are there *disparities* in use of these services across New York City subpopulations defined by race, ethnicity, socioeconomic, and demographic characteristics?

- Has the *rate of change over time* in use of these basic preventive services been equivalent across subpopulations – or have some groups shown faster (or slower) rates of change over time?

Previous Research

Disparities. Access to health care has been one of the most contentious social and political issues of the last several decades in the USA. As a result, a substantial body of literature exists on racial disparities with suggestive findings as to the causes for existing disparities. Overall, racial and ethnic minorities and the economically disadvantaged have been found to have lower rates of basic preventive care including: Pap smear testing[2]; colon cancer screening[5] [6] [7]. In addition, Black, Hispanic, and Asian adults are widely

reported to have particularly low rates of basic preventive care. According to one New York City study, "Chinese participants reported lower rates of screening utilization" for breast, cervical, colorectal and prostate cancer than other participants and were "less likely than Hispanic or Black patients to perceive that they would develop" any of those cancers some day[8].

There are, however, exceptions to these general findings. Using data from the 2002 New York City Community Health Survey (NYC-CHS), Nash et al[3] found a higher rate of pap-smear testing and mammograms among non-Hispanic Black women than among other women in New York. They speculated that this was due to screening campaigns "implemented in under-served minority communities" in New York City[3].

Motivators and Barriers. While the present article does not focus on factors that encourage and inhibit use of basic preventive services, it is valuable to note that the recommendations of primary care physicians have been found to be one of the most potent motivators for cancer screening in community-based studies[5]. So, for example, in one study of colorectal screening among low income immigrant Hispanics in New York City, such recommendations yielded "more than a 66-fold increase in reported screening rates"[6]. It is for this reason that we include "having a primary care physician" as one of our basic preventive care indicators.

There are a myriad of barriers to accessing preventive care services. These include lack of economic resources, health insurance, accessible health care settings, etc. There are also sociocultural barriers. It has been reported that Blacks, Hispanics and Asians "perceived themselves [to be] at lower risk for getting cancer than White respondents" [9]. In the case of colonoscopies, it has been suggested that the "personal nature" of the procedure, "the cultural perception of cancer, and not wanting to know if cancer existed ... were the greatest perceived barriers to being screened"[10]. Similarly, a study of Chinese women's screening behaviors has speculated that "access obstacles are likely multiplied when a woman holds strong Eastern views of care such as viewing cancer as a result of fate; preferring herbal medicine to Western medicine; and stressing self-care over medical check-up[s]"[11].

METHODS

Full descriptions of the New York City Community Health Surveys' (NYC-CHS) sample design, survey execution, interview procedures, and sample weighting have been published elsewhere (see NYC DOHMH reports available at: http://www.nyc.gov/html/doh/html/data/chs-data.shtm.) We provide

summary descriptions below (see Text S1); readers may consult the original sources for more complete information.

Sample Design. The NYC-CHS surveys were designed to draw annual representative samples of the non-institutionalized, telephone-accessible population of New York City from 2002 onwards. The present report uses data from the annual surveys conducted in 2002 through 2011; it does not include the special smoking supplement conducted in 2003. (Details of data extraction and recoding are presented in Text S2.) New York residents ages 18 and over were recruited in a probability sample of households with landline telephones in 2002 to 2008. From 2009 onwards, a probability sample of adults who were reachable only by cell phone was added to the sample design. Since this addition creates a potential non-equivalence of the populations sampled in 2002 - 2008 versus 2009 - 2011, we conducted methodological analyses to assess the extent to which this addition affects our estimates (see Tables S1through S3). Based on the findings of statistically significant effects in these analyses, all of our substantive analyses incorporate a control variable identifying respondents recruited from the "cell phone only" stratum.

Sample Execution. Excluding the special 2003 smoking supplement, a total of 93,125 adults were interviewed in the NYC-CHS survey program between 2002 and 2011. As with most contemporary surveys conducted by telephone[12], recruiting and completing interviews with target respondents was challenging. The NYC-CHS surveys' ***cooperation rate*** – defined as the number of persons interviewed divided by the number of persons identified as eligible for interview – fluctuated from 63% in 2003-04 to 91% in 2006 (see Table 1). A more conservative measure of response rate[13] that also takes account of screening failures to determine eligibility ranged from 29% in 2004 to 40% in 2011. Since fluctuations in survey cooperation and response rates can affect our key measurements (see Table S4), we will employ these factors as control variables in our analyses.

Survey Interview. The annual NYC-CHS survey "includes approximately 125 questions, covering the following health topics: general health status and mental health, health care access, cardiovascular health, diabetes, asthma, immunizations, nutrition and physical activity, smoking, HIV, sexual behavior, alcohol consumption, cancer screening and other health topics. A core group of demographics variables are included every year to facilitate weighting and comparisons among different groups of New Yorkers (http://www.nyc.gov/html/doh/html/data/chs-methods.shtml; accessed July 4, 2014)."

The NYC-CHS is conducted using a Computer-Assisted Telephone Interviewing (CATI) system with questions programmed in both English and Spanish. Provisions have been made for interviewing in a

variety of other languages (e.g., Mandarin, Russian, etc.; see Text S3). Telephone survey interviewing for the NYC-CHS was conducted by the Baruch College Survey Research Unit from 2002 to 2007 and by Abt/SRBI from 2008 onwards.

Sample Weighting. The survey organizations created weights to adjust for the inverse of the initial probability of respondent selection. This weight varied with the number of eligibles in the household and the number of telephone numbers the household might have been reached on. A subsequent post-stratification adjustment "weight[ed] each record up to the population of the UHF neighbourhood, while taking into account the respondent's age, gender and race. Starting in 2009, responses in the landline stratum were also weighted to account for the distribution of the adult population comprising three telephone usage categories (landline only, landline and cell, cell only) using data from the 2008 New York City Housing and Vacancy Survey (http://www.nyc.gov/html/doh/html/data/chs-methods.shtml; accessed 5-9-2014)". Beginning with the 2011 NYC-CHS, population controls were updated to use the 2010 Census and the population living in non-residential group quarters was excluded from the population controls. In addition, borough-level controls were expanded to include: marital status, education, number of adults in household, and presence of children in household.[14]

The primary focus of the present study was the measurement of trends in seven preventive health behaviors. While we measured trends by combining data across all available years for each measure, the focus remained on individual year estimates. Individual year estimates are poststratified by age, gender, and race for all years and by telephone usage categories (landline only, landline and cell, and cell only). We recognized that finer poststratification could be applied to a combined sample, but these composite adjustments might actually disturb individual year estimates in a manner that increases bias in annual estimates. We note that independent samples were drawn each year using often similar sampling strata. For our analyses we created a new stratification variable that crosses year with the individual year strata. We thereby preserved the analytic capability of generating poststratified estimates within year and enabled comparisons across years. Using the annual weights for any combined year analysis essentially weights each year by its estimated population. (Annualized estimates of population totals using all years of available data could be obtained by dividing the multi-year weighted total by the number of years with data available for each particular behavior.)

It should be recognized that the annual data available for each preventive health behavior varies from as few as four years for "Always got Care in the Past Year" to nine years for "Colonoscopy Every 10 Years". Furthermore, even when two behaviors have data available for the same number of years, the particular years may not match. Our approach to defining the analysis strata by crossing year with

within-year strata not only provides for better annual estimates, but it also avoids the problem of defining special multi-year composite weights based on a more detailed poststratification for each combination of available data years.

Key Trend Measurements. Seven preventive behavior variables were selected for trend analysis from the NYC-CHS. These variables reflect consensus health care recommendations for the US and other populations:

All adults should receive needed medical care[15]

All adults should have a primary care physician in order to provide continuity of care over time[15];

All adults should have their cholesterol tested at least every five years[16].

All adults should have a colonoscopy at age 50 and once every 10 years until age 75[17].

All adults should receive a flu shot every year to prevent the spread of influenza[18].

All women should have a pap test every three years beginning at age 21. Women over age 65 who have had "regular cervical cancer testing with normal results" should not be tested.[19]

All women should have biennial mammograms from age 50 to 74.[20]

Institutional Review. The present article reports secondary analyses of NYC-CHS public use datasets that are posted on the Internet and freely available to the public. As such, our study did not require institutional review (see Text S4).

Data Availability. These public use data are posted on the internet and accessible without restriction at: http://www.nyc.gov/html/doh/html/data/chs-data.shtml .

Statistical Analyses. Our primary analyses will test the trends in use of our seven preventive health services over time. Since our dependent variables are binary (e.g., have a primary care physician, yes or no), we will use logistic regression. Our initial analyses will test hypotheses that the odds of receiving these seven preventive health services increased over the years from 2002 to 2011 (raw ORs) and that any

observed increases persisted when controls were applied for variations over time in survey procedures and execution (survey adjusted ORs). Subsequent analyses will test for disparities in the *overall level of use* of these preventive health services by New York subpopulations defined by their sociodemographic characteristics (e.g., gender, race, age, etc.). Our final substantive analyses will assess whether the *trends over time* in use of preventive services varied for subpopulations defined by their sociodemographic characteristics. As noted previously, our analyses include controls for the impact on our estimates of annual fluctuations in response and cooperation rates and the inclusion of cell phone sample strata in 2009 - 2011. All statistical analyses will use the ***svy*** procedures of Stata version 12 to accommodate the weighting and complex sample design of the NYC-CHS surveys.

RESULTS

Annual Trends. Figure 1 presents the estimated annual prevalences of each of the seven preventive health services we are tracking. These estimates take account of the complex sample design of the NYC-CHS in each year. Estimates for years 2009 to 2011 include data from both the landline phone strata included in 2002 to 2008 and the cell phone strata that was added in 2009. While respondents in the "cell phone strata" have lower participation rates in preventive health services, the impact of adding this strata on trend measurements is not substantial (see Table S3). Estimated annual prevalences derived using only landline telephone strata are shown in Figure S1.

The estimated population prevalence of 5 of the 7 preventive health services fluctuates in the range of 74 to 90 %. The two exceptions are getting flu vaccinations in the past year which increases from 26% in 2006 to 40% in 2011 and getting colonoscopies in the past 10 years for persons ages 50 to 75 years which increases from 41% in 2003 to 66% in 2011.

As noted previously, Figure 1 does not take account of the addition of the cell phone strata in 2009 nor the substantial variation of the response and cooperation rates in the annual NYC-CHS surveys. To provide a more secure basis for inference, Table 2 provides estimates of the (linear) annual change in the odds that respondents would report use of each preventive health service controlling for both inclusion of the cell phone strata and variation in the annual surveys' cooperation and response rates. It will be seen from Table 2 that — with the exception of cholesterol testing and "always receiving care" — the trends over time are statistically significant and positive.

Estimates of the rate of annual change in the five remaining indicators were statistically significant and often quite substantial. So, for example, the estimated odds of having a primary care physician, receiving a flu vaccination in the past year, and having had a colonoscopy in the past 10 years (for persons 50 to 75) increased at annual rates of 1.13 or greater. However, linear trend estimates are less substantial for the two female-specific indicators: having a mammogram in the past two years for women ages 50 to 74 (Adj. OR = 1.04, p = 0.009) and having a pap smear in past three years for women ages 21 to 65 (Adj. OR = 1.03, p = 0.035).

Subpopulation disparities. Table S5 shows subpopulation variations in each of the five preventive health indicators recommended for both men and women over the time periods for which comparable NYC-CHS measurements are available. This table reveals both disparities that are expected given past research and others that are unexpected. Thus we find greater utilization of preventive health services by the white and more educated subpopulations and substantially lower rates by the uninsured and poorer segments of the population of New York City. The latter effects are quite dramatic. So, for example, only 43% of the uninsured reported having a primary care physician and only 38% of the uninsured in the age range 50 to 75 reported having a colonoscopy in the past ten years. Among New Yorkers with private health insurance or Medicare, the corresponding percentages are 88 to 90% and 62 to 67% (*p*s < 0.001 for variation across 5 categories of insurance coverage). Similarly, poverty status has a consistent inverse linear association with 4 of the 5 preventive health services recommended for both males and females — the more impoverished the subpopulation, the lower the utilization of preventive health services (*p*s < 0.001). The exception to this result is for flu vaccination for which the linear association is not statistically significant (p = 0.125). There is, however, a statistically significant variation in flu vaccination by the language spoken in the respondent's home. Thus 41% of persons residing in Chinese-speaking households reported flu vaccination in the past year versus 33% and 29% for persons resident in English- and Spanish-speaking households (p < 0.001 for variation across 6 language categories).

Table S6 presents the results for two preventive health services recommended for women: mammograms for women ages 50 to 74 and pap smears for women ages 21 to 65. This table contains several surprises. So, for example, the race-ethnicity disparity in mammogram screening is the reverse of what might be expected — the reported screening rate for black women is significantly higher than that for white women (83% vs. 79%; AOR = 1.37, p < 0.001). The reported screening rate for Hispanic women also exceeds that for white women (85% vs. 79%, AOR = 1.54, p < 0.001). Indeed, women living in households that speak Spanish have a higher rate of mammogram screening than those who live in households that speak English (87% vs. 80%, AOR = 1.71 , p < 0.001). We also find that pap smear screening rates for cervical cancer are particularly low for women whose home languages are Chinese (66%) or Indian (62%) versus

women whose home languages are English (88%) or Spanish (87%). (AOR = 0.27 for comparison of Indian+Chinese [65%] vs. English+Spanish [88%], $p < 0.001$).

Table S6 also shows that there is no significant linear association between education level and the prevalence of mammogram screening ($p = 0.242$). Thus the screening rate for women with less than a high school education is equivalent to that for college graduates (82% vs. 83%). We do find, however, a modest linear trend for mammogram screening to increase slightly with decreasing poverty ($p = 0.003$ for linear trend). Thus women with household earnings below 400% of the poverty level have a screening rate of 78% to 80% versus 83% for women living in households with incomes greater than 400% of the poverty level. Age has a relatively weak association with both mammogram and cervical screening although the large sample sizes make some of these results statistically significant. Mammogram screening varies between 79% and 83% for the applicable age groups (ages 50 to 74) while cervical cancer screening (pap smears) fluctuate between 80% and 89% for women ages 21 to 65. We also find that cervical screening but not mammography are more common among New Yorkers born in the USA than those born in other countries (88% vs. 82%, $p < 0.001$). As might be expected, lack of health insurance is associated with lower utilization of both mammograms (61% No Insurance vs. 83% Have Insurance; $p<0.001$) and cervical screening using pap smears (74% No Insurance vs. 87% Have Insurance; $p<0.001$).

Interaction Analyses: Subpopulation Variation in Rates of Annual Change. Our final analyses assess the extent to which annual linear trends in each preventive health indicator varies across subpopulations. These analyses seek to answer questions like: Were (linear) trends in the utilization of mammography over time more rapid in some racial or ethnic groups? In considering these analyses, it is important to bear in mind that – unlike Tables S5 and S6 – these analyses focus on the *annual rate of change* in utilization of preventive health services and not on the mean level of utilization by the group. So, for example, it is possible for one ethnic group to have *a lower overall rate of utilization* of a service across the time period but a *more rapid estimated annual increase* in the odds that group members would use the service.

Given our 7 preventive health services and 10 sociodemographic variables, we conducted 70 interaction analyses. Each analysis used logistic regression to separately estimate the expected annual (linear) changes in the odds of use of each preventive health care service as a function of year and the interaction of *year by each sociodemographic variable.* This was done separately for each combination of a preventive service and a sociodemographic variable, and it yielded estimated composite coefficients for combinations such as: (1) estimated annual change in mammography screening for white females, black

females, Hispanic females, etc.; estimated annual change in colonoscopy screening for white adults, black adults, Hispanic adults, etc.

Given our relatively large sample sizes, the 70 interaction analyses performed, and the fact that some interaction analyses (e.g., by decade of age or by employment status) fit up to eight interaction terms, it is not surprising that many of our interaction results – although statistically significant – will be substantively inconsequential and possibly spurious. We have therefore restricted our presentation in Table 3 to interaction findings that were significant beyond the 0.001 level. (The complete set of results significant at $p < 0.05$ are presented in Table S7.)

The analyses shown in Table 3 indicate that the estimated *rates of annual change* in flu vaccinations were higher for Asian and Hispanic New Yorkers (composite estimated rates of annual change in odds are 1.237 and 1.194). (Composite estimated rates are the product of the AOR for the estimated annual change in odds multiplied by the AOR for the year-by-demographic interaction variable.) Similarly we find that these estimated rates of annual change increased more rapidly for younger New Yorkers (estimated annual rates: 1.15 to 1.16 for adults ages 18 to 59) than for adults in their 60s through 80s (estimated annual rates of 1.04 to 1.07). It should be borne in mind that these estimates are for estimated *annual change* in the odds of receiving a vaccination. The *overall level* of flu vaccination is nonetheless much higher among the elderly than the young (e.g., 21% for adults 18-29 vs. 66% for adults 80 and older).

Similarly we note that students showed a much more rapid estimated annual increase in their odds of "always" getting care (1.569) and "homemakers" showed a slight annual decrease in their odds of always getting care (0.981). Finally we note that New York women born outside of the USA had a more rapid annual increase in their odds of having a pap smear in the prior three years (1.091) while women born in the United States also showed a slight annual decrease (0.980).

DISCUSSION

The foregoing results suggest that access to and use of preventive health care services in New York City improved during the first decade of the 21st century. More New Yorkers now have primary care physicians and there have been substantial increases in colonoscopies and flu vaccinations. In each of these three instances, the estimated (linear) annual change in the odds of a New Yorker receiving these preventive services exceeded 1.10 per year and was statistically significant beyond the 0.001 level.

Yet, in spite of such improvements, the odds of a New Yorker saying that they *always received needed medical care* were stagnant — with approximately 10% of New Yorkers replying that they had ***not*** always received needed care in the past year. In addition, only small gains were found in screening of women for breast and cervical cancer. While the prevalence of these screenings over the time period 2002 to 2010 were quite high (81% and 85%), the estimated annual increase in the odds of these screenings were only 1.04 and 1.03 respectively. This is surprising given the increase over the decade in the odds that a woman would have a primary care physician. It is possible, of course, that this may be a ceiling effect given the high prevalence of use of these preventive services. It is also possible, however, that women may delay or defer appointments due to the invasive and personal nature of these screenings. This may be particularly likely for Asian women who show the lowest rates of breast and cervical screening. Yet, considering that there is a significant linear association between income and the odds of screening, the expense in time and money of these screenings may be a more plausible factor keeping some women from receiving timely tests. Clearly, greater efforts will be required to further improve the relatively high rates of screening for breast and cervical cancers among New York women.

Although annual flu vaccinations have surged in recent years, the current population prevalence of 39% leaves much room for improvement. Indeed, even among New Yorkers in their eighties – the most vulnerable segment of the population – only 66% reported receiving a flu vaccination in the prior year. Yet, the 2010 surge in seasonal flu vaccinations in response to the H1N1 scare teaches an important lesson. It suggests that such growth can be sustained. Although it took the threat of a flu pandemic to spur New Yorkers to action, vaccination rates did not fall after the scare subsided. This suggests that widespread community outreach to counter a public health threat can result in persistent improvements in preventive health behaviors. We would also note that Medicaid recipients in New York were more likely to have received a flu vaccination than New Yorkers with any other type of insurance — suggesting that targeting vaccination outreach on the city's poorest residents was surprisingly successful.

While racial differences in the use of preventive health services were not statistically significant in many cases, there were some surprising exceptions. Black and Hispanic women were much more likely than

white women to have received timely mammograms and pap smears, suggesting that outreach efforts in these communities can be particularly effective — as Nash et al. previously observed. In contrast, Asian women were far less likely than their peers to have received the same services. The fact that the Asian community also has low utilization of colonoscopies while having excellent access to primary care physicians and flu shots suggests that the problem may be due to cultural factors or lack of access to appropriate medical specialists.

It has been noted that minorities often prefer to see physicians of their own ethnicity, especially if English is not their primary language [21 22]. It is thus possible the issue is an inadequate supply of Asian doctors practicing in the required specialties (gynecology, mammography, endoscopy) in New York City. Alternatively, since the lack of access appears to be limited to cancer screenings, low utilization may be the result of a preference for alternative medicine in the Asian community over "Western medicine," as previously reported in the literature[11]. Perhaps New Yorkers from the Asian and Indian communities are choosing such alternative medical services as a replacement for conventional cancer screenings. This is clearly an important problem that deserves further research.

Limitations and Needs for Future Research. This research is a secondary analysis of telephone survey data collected for the NYC Department of Health and Mental Hygiene. As such, there are unavoidable limitations on our inferences. On the technical side, we note the inferential problems created by the increasing number of households who are accessible only by cell phone. The NYC Community Health Survey surveyed only households with landline telephones prior to 2009. Over the time period 2001 to 2008, the proportion of the adult population reached in landline surveys declined in the USA and presumably in New York City as well[23]. The inclusion in 2009 of a sampling stratum of adults who were only reachable by cell phone ameliorated this problem, but it created a further complexity for studies of trends over time. Specifically, to infer change over time, one must account for the impact of the inclusion of the “cell phone only” stratum in 2009. We have taken two approaches to this inferential challenge. First, we included a binary control variable in our analyses to identify persons in the “cell phone only” stratum and “adjusted” for this factor. Second, we have provided (in Supporting Information) alternative estimates derived solely from the landline sampling strata. While these are two reasonable accommodations, they do not guarantee that we can make error-free inferences about trends over time in preventive health behaviors.

We also note that a similar problem arises from the low and varying response rates achieved by the annual NYC-CHS surveys. As shown in Table 1, response rates were low, and they varied from 29% to 40% in the time period 2002 to 2011. While our analyses (Table S4) indicated that variation in annual

cooperation and response rates had a weak association with reporting of our seven key preventive health indicators, we included response and cooperation rates as control variables in all of our analyses. Here again, while this is a reasonable accommodation, it does not guarantee that we can make error-free inferences about trends over time in preventive health behaviors.

Finally we note the most important threat to inference is our research. Our analyses depends upon the verbal report of survey respondents. While mis-reporting affects estimates of the prevalences of preventive health behaviors, *per se,* it does not necessarily affect our most important inferences about change over time in these behaviors and variation across subpopulation groups in these behaviors. *While there is no evidence that rates of misreporting of these behaviors varies substantially from year to year, there is very suggestive evidence that misreporting can vary substantially across subpopulations.* Njai et al.,[24] for example, report that self-report data overestimate mammography use and that this over-reporting is more severe among black women. Such differential validity undermines inferences about subpopulation variations. Thus we do not know if our finding of higher mammography screening rates among black than white women (83% vs. 79%) reflects a true population differences or a difference in the misreporting rate. Similar uncertainties plague all inferences on subpopulation differences in health behaviors based on self report data.

Given the ubiquity of the BRFSS and similar surveys that use self-report to assess preventive health behaviors, methodological research on the differential validity of such self-report measures over time and subpopulations should be a public health research priority.

Author Contributions

Obtained and managed data: CFT. Designed analyses: MEC, JRC, CFT. Analyzed the data: MEC, CFT. Wrote the paper: MEC, CFT, JRC. Review of manuscript for critical content: MEC, JRC, CFT.

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SUPPORTING INFORMATION

Figure S1

Annual estimates of preventive health care indicators for New York City population, 2002 to 2011. Estimates derived from 2002 – 2011 NYC Community Health Survey *using only landline sampling strata* (2002–2011).

Table S1.

Comparison of estimates of preventive health outcomes for weighted sample for 2009 to 2011 comparing landline strata to "cell phone only" stratum.

Table S2.

Age distribution of weighted sample for 2009 to 2011 comparing landline strata to "cell phone only" stratum.

Table S3.

Estimated annual change in 6 preventive health care services in New York City population, 2002 to 2011: Comparison of results that include or exclude data from "cell phone only" survey stratum.

Table S4.

Estimated adjusted odds ratio for association of cooperation and response rates with estimates for preventive health indicators.

Table S5.

Variations across subpopulations in indicators of preventive health services recommended for both men and women.

Table S6.

Variations across subpopulations in indicators of preventive health services recommended for women.

Table S7.

Interaction analysis: Instances that reject (with $p < 0.05$) the null hypotheses that annual rates of change in odds of use preventive health services are equivalent across subpopulations.

Text S1 Disclaimer

Text S2 Documentation for Variables Used in Analyses

Text S3 Interview Languages

Text S4 IRB Exemption for Analyses of Public Use Data

References

1. Lee BA, Iceland, J., Sharp, G. *Racial and Ethnic Diversity goes local: Charting change in American Communities over three decades*: Pennsylvania State University;2012.

2. Ackerson K, Gretebeck K. Factors influencing cancer screening practices of underserved women. *J Am Acad Nurse Pract.* Nov 2007;19(11):591-601.

3. Nash D, Chan C, Horowitz D, Vlahov D. Barriers and missed opportunities in breast and cervical cancer screening among women aged 50 and over, New York City, 2002. *J Womens Health (Larchmt).* Jan-Feb 2007;16(1):46-56.

4. Partnership For Prevention. *Preventive Care: A National Profile on Use, Disparities, and Health Benefits.* Washington DC2007.

5. Guerrero-Preston R, Chan C, Vlahov D, Mitchell MK, Johnson SB, Freeman H. Previous cancer screening behavior as predictor of endoscopic colon cancer screening among women aged 50 and over, in NYC 2002. *J Community Health.* Feb 2008;33(1):10-21.

6. Jandorf L, Ellison J, Villagra C, et al. Understanding the barriers and facilitators of colorectal cancer screening among low income immigrant hispanics. *J Immigr Minor Health.* Aug 2010;12(4):462-469.

7. Crawford ND, Blaney S, Amesty S, et al. Individual- and neighborhood-level characteristics associated with support of in-pharmacy vaccination among ESAP-registered pharmacies: pharmacists' role in reducing racial/ethnic disparities in influenza vaccinations in New York City. *J Urban Health.* Feb 2011;88(1):176-185.

8. Lubetkin EI, Santana A, Tso A, Jia H. Predictors of cancer screening among low-income primary care patients. *J Health Care Poor Underserved.* Feb 2008;19(1):135-148.

9. Orom H, Kiviniemi MT, Underwood W, 3rd, Ross L, Shavers VL. Perceived cancer risk: why is it lower among nonwhites than whites? *Cancer Epidemiol Biomarkers Prev.* Mar 2010;19(3):746-754.

10. Bass SB, Gordon TF, Ruzek SB, et al. Perceptions of colorectal cancer screening in urban African American clinic patients: differences by gender and screening status. *J Cancer Educ.* Mar 2011;26(1):121-128.

11. Wang JH, Mandelblatt JS, Liang W, Yi B, Ma IJ, Schwartz MD. Knowledge, cultural, and attitudinal barriers to mammography screening among nonadherent immigrant Chinese women: ever versus never screened status. *Cancer.* Oct 15 2009;115(20):4828-4838.

12. Pew Research Center for the People and the Press. *Assessing the Representativeness of Public*

Opinion Surveys. Washington DC2012.

13. American Association for Public Opinion Research. *Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys.* Lenexa, Kansas: AAPOR;2009.

14. Norton JM, Sanderson M, Gupta L, Holder-Hayes E, Immerwahr S, Konty K, Olson C, Eisenhower D. Methodology Updates to the New York City Community Health Survey, New York City Community Health Survey*; Epi Research Report*, September 2012, 1-12.

15. US Department of Health and Human Services. Access to Health Services. 2014; http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicId=1. Accessed 7/26/14, 2014.

16. US Department of Healthand Human Services. Heart Disease and Stroke. 2014; http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=21. Accessed 7/26/14, 2014.

17. US Preventive Services Task Force. Screening for Colorectal Cancer. 2008; http://www.uspreventiveservicestaskforce.org/uspstf/uspscolo.htm. Accessed 7/26/14, 2014.

18. US Department of Health and Human Services. Immunization and Infectious Diseases. 2014; http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=23. Accessed 7/26/2014, 2014.

19. US Preventive Services Task Force. Screening for Cervical Cancer 2012; http://www.uspreventiveservicestaskforce.org/uspstf/uspscerv.htm. Accessed 7/26/14, 2014.

20. US Preventive Services Task Force. Screening for Breast Cancer. 2009; http://www.uspreventiveservicestaskforce.org/uspstf/uspsbrca.htm. Accessed 7/26/14, 2014.

21. Laveist TA, Nuru-Jeter A. Is doctor-patient race concordance associated with greater satisfaction with care? *J Health Soc Behav.* Sep 2002;43(3):296-306.

22. Traylor AH, Schmittdiel JA, Uratsu CS, Mangione CM, Subramanian U. The predictors of patient-physician race and ethnic concordance: a medical facility fixed-effects approach. *Health Serv Res.* Jun 2010;45(3):792-805.

23. Blumberg SJ, Ganesh N, Luke JV, Gonzales G. Wireless substitution: state-level estimates from the National Health Interview Survey, 2012. *Natl Health Stat Report.* Dec 18 2013(70):1-16.

24. Njai R, Siegel PZ, Miller JW, Liao Y. Misclassification of survey responses and black-white disparity in mammography use, Behavioral Risk Factor Surveillance System, 1995-2006. *Prev Chronic Dis.* May 2011;8(3):A59.

FIGURE CAPTIONS

Figure 1. Annual estimates of preventive health care indicators for NYC population, 2002 to 2011. (Percent of adults reporting use of service estimated from both landline and cell phone data; see text.)

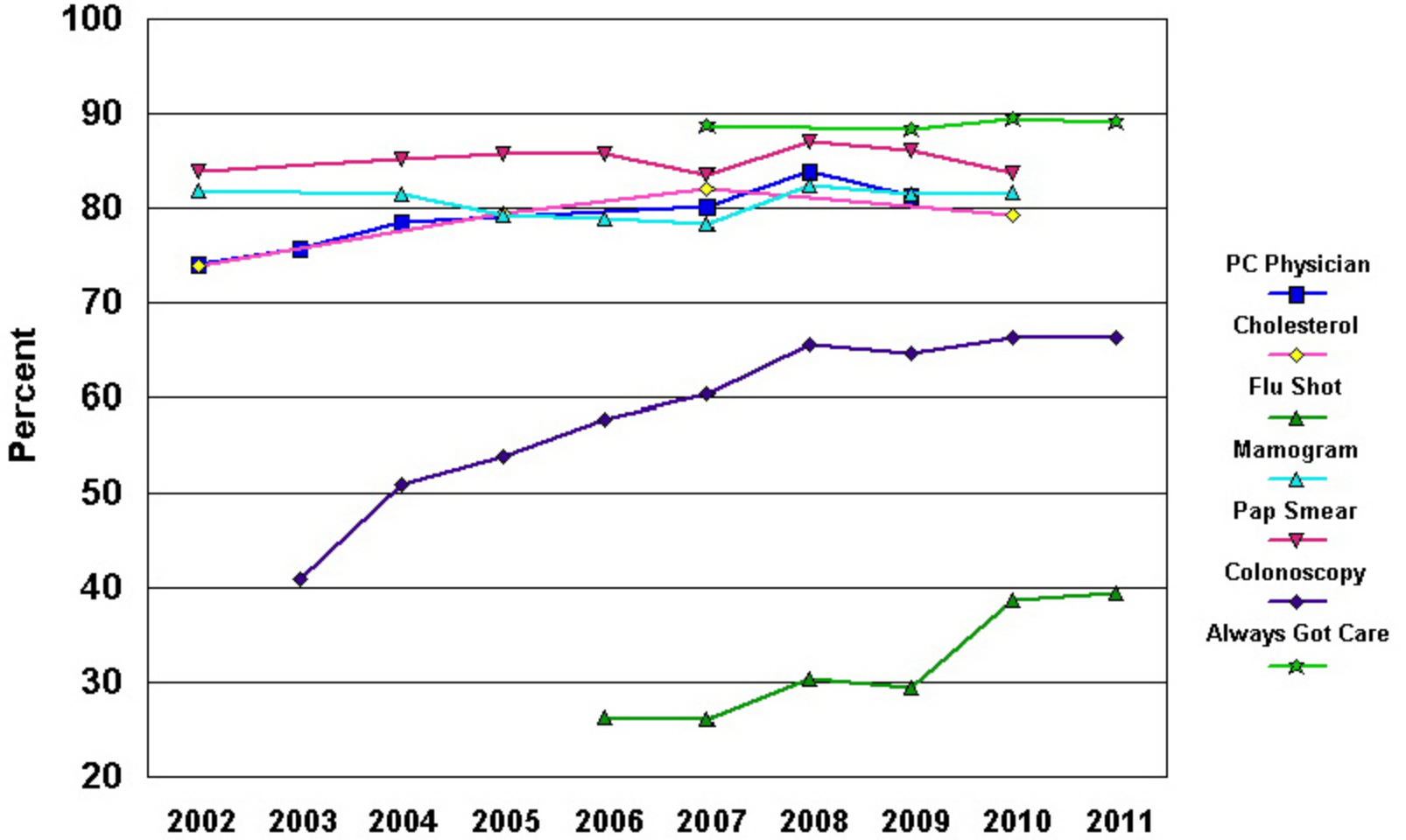

100
90
80
70
60
50
40
30
20
Percent
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
PC Physician
Cholesterol
Flu Shot
Mamogram
Pap Smear
Colonoscopy
Always Got Care

TABLE 1. New York City Community Health Survey: Annual Sample Sizes, Response Rates, and Cooperation Rates, 2002 to 2011.

YEAR	N	Response Rate (b)	Cooperation Rate (b)
2002	9,674	36.0%	69.0%
2003	9,802	44.2%	63.3%
2004	9,585	29.0%	62.5%
2005	9,818	38.7%	79.3%
2006	9,714	35.8%	90.7%
2007	9,554	32.8%	90.4%
2008	7,554	33.3%	80.7%
2009 (a)	9,934	37.7%	89.5%
2010 (a)	8,665	39.0%	89.4%
2011 (a)	8,792	40.0%	89.1%

(a) For 2009 through 2011, cooperation and response rates are combined landline and "cell phone only" strata.

(b) AAPOR Cooperation Rate 3 and Response Rate 3.

SOURCE: New York City Department of Health and Mental Hygiene, Survey Data on the Health of New Yorkers: Community Health Survey: Methodology. Published online at: http://www.nyc.gov/html/doh/html/data/chs-methods.shtml. Accessed July 2, 2014.

TABLE 2. Estimated annual change in odds for 7 preventive health indicators in the New York City population, 2002 to 2011 (controlling for survey sampling and execution factors).

PREVENTIVE HEALTH INDICATOR	**Est. Annual Change**		
	Adj. OR	**95% CI**	**P**
Have Primary Care Physician	1.133	1.108, 1.158	<0.001
Always Received Needed Medical Care	1.159	.956, 1.405	0.133
Cholesterol Tested in Past 5 Years	0.974	.916, 1.036	0.411
Flu Vaccine in Past Year	1.147	1.114, 1.181	<0.001
Colonoscopy in 10 years (50-74 yrs olds)	1.136	1.114, 1.159	<0.001
Mammogram in 2 years (Females 50-74 yrs old)	1.044	1.011, 1.078	0.009
Pap Smear in 3 yrs (Females 21-65 yrs old)	1.031	1.002, 1.061	0.035

Note. ORs are the coefficient in OR format derived from the logistic regression of the Preventive Health Service (coded 1 if service was received; zero otherwise) on Year. The adjusted ORs include controls for inclusion of cell phone strata, survey response rate, and survey cooperation rate. All analyses include data from "cell phone only" stratum, See Table S3 for comparison of results using only data from landline survey strata *versus* data from both landline and cell phone strata.

TABLE 3. Interaction analysis: Instances that reject (with p 0.001) the null hypotheses that annual rates of change in odds of use preventive health services are equivalent across subpopulations.

PREVENTIVE HEALTH INDICATOR	INTERACTING VARIABLE	CATEGORY	COMPOSITE ANNUAL EFFECT	P Interaction
Always got care, 1 year	**Employment**	Employed	1.121	<0.001
		Self Employed	1.284	
		Unemploy>1 yr	1.180	
		Unemploy <1 yr	1.272	
		Homemaker	0.981	
		Student	1.569	
		Retired	1.036	
		Disabled	1.270	
Flu Vaccination, 1 year	**Race - Ethnicity**	White	1.091	<0.001
		Black	1.165	
		Hispanic	1.194	
		Asian	1.237	
		Other	1.060	
	Age in decades	18-29	1.160	<0.001
		30s	1.153	
		40s	1.153	
		50s	1.152	
		60s	1.075	
		70s	1.042	
		80s	1.074	
Pap Smear, 3 years	**Born in USA**	No	1.091	< 0.001
		Yes	0.980	

Note. See Table S7 for full set of interaction results and the two components of the composite annual effect (annual change and Interaction effect). P value is for test of the null hypothesis that annual change was equivalent across categories of the interacting variable. Estimates of composite annual effects and survey-adjusted p-values include controls for survey response rate, survey cooperation rate, and inclusion of "cell phone only" stratum.

TABLE S1. Comparison of estimates of preventive health outcomes for weighted sample for 2009 to 2011 comparing landline strata to "cell phone only" stratum.

OUTCOME	STRATA			P
	Landlines	Cell Phone Only	Combined	
Have Primary Health Care Provider	90.2%	86.4%	89.0%	< 0.0001
Always got needed medical care in past year	90.2%	86.4%	89.0%	< 0.0001
Cholesterol test in past 5 years	82.6%	68.0%	79.3%	< 0.0001
Flu vaccination in past year	39.5%	28.0%	35.9%	< 0.001
Colonoscopy in past 10 years (ages 50 - 75)	67.9%	56.3%	65.9%	< 0.0001
Mammogram in past 2 years (Women ages 50 - 74)	81.9%	79.1%	81.6%	> 0.50
Pap test in past 3 years (Women ages 21 - 65)	86.0%	81.7%	85.0%	0.030

TABLE S2. Age distribution of weighted sample for 2009 to 2011 comparing landline strata to "cell phone only" stratum.

AGE	STRATA		
	Landlines	Cell Phone Only	Combined
18-29	16.6%	37.8%	23.2%
30s	18.9%	28.7%	22.0%
40s	19.4%	15.4%	18.2%
50s	17.1%	10.6%	15.1%
60s	14.2%	5.4%	11.4%
70s	9.0%	1.7%	6.7%
80+	4.8%	0.4%	3.5%

$P < 0.0001$

TABLE S3. Estimated annual change in 7 preventive health care services in New York City population, 2002 to 2011: Comparison of results that include or exclude data from "cell phone only" survey stratum.

PREVENTIVE HEALTH SERVICE	Est. Annual Change			
	Include "Cell Phone Only" Stratum		Exclude "Cell Phone Only" Stratum	
	Adj. OR	P	Adj. OR	P
Have Primary Care Physician [a]	1.133	<0.001	1.133	<0.001
Always Received Needed Medical Care [b]	1.159	0.133	0.937	0.498
Cholesterol Tested in Past 5 Years [c]	0.974	0.411	0.975	0.411
Flu Vaccine in Past Year [b]	1.147	<0.001	1.146	<0.001
Colonoscopy in 10 years (50-74 yrs old) [b]	1.136	<0.001	1.137	<0.001
Mammogram in 2 years (Females 50-74 yrs old) [d]	1.044	0.009	1.042	0.012
Pap Smear in 3 yrs (Females 21-65 yrs old) [d]	1.031	0.035	1.036	0.015

Note. Adjusted ORs are the coefficient in OR format derived from the logistic regression of the Preventive Health Service (coded 1 if service was received; zero otherwise) on Year with controls for survey execution variables: survey Cooperation Rate and survey Response Rate. Analyses that include "cell phone only" stratum include an additional control indicating whether the respondent was drawn from the survey's "cell phone only" stratum.

[a] Question was asked in the 2009 survey which included a "cell phone only" stratum..

[b] Question was asked in the 2009, 2010, and 2011 surveys which included "cell phone only" strata..

[c] Question was asked in the 2010 survey which included a "cell phone only" stratum.

[d] Question was asked in the 2009 and 2010 surveys.which included "cell phone only" strata.

TABLE S4. Estimated adjusted odds ratio for association of cooperation and response rates with estimates for preventive health indicators.

PREVENTIVE HEALTH INDICATOR & Survey Execution Variable	Response Rate			Cooperation Rate			Coop & Response Rates
	Adj. OR	95% CI	P	Adj. OR	95% CI	P	P
Have Primary Care Physician	1.000	0.995, 1.01	> 0.50	0.993	0.988, 0.998	0.004	0.015
Always Received Needed Medical Care	1.017	0.817, 1.267	> 0.50	1.432	0.476, 4.304	> 0.50	> 0.50
Cholesterol Tested in Past 5 Years	1.023	0.997, 1.049	0.086	1.033	1.013, 1.053	0.001	0.002
Flu Vaccine in Past Year	1.044	1.023, 1.065	< 0.001	0.993	0.983, 1.003	0.15	< 0.001
Colonoscopy in 10 years (50-74 yrs old)	0.982	0.975, 0.989	< 0.001	1.004	0.997, 1.008	0.07	< 0.001
Mammogram in 2 years (Females 50-74 yrs old)	1.011	0.992, 1.031	0.255	0.986	0.978, 0.995	0.001	0.006
Pap Smear in 3 yrs (Females 21-65 yrs old)	1.005	0.988, 1.021	> 0.50	0.995	0.988, 1.003	0.225	0.477

Note. Adjusted ORs are the coefficient in OR format derived from the logistic regression of the Preventive Health Service (coded 1 if service was received; zero otherwise) on Year, Cooperation Rate, Response Rate, and whether or not subject was in the "cell phone only" stratum. This table shows results for the two survey execution variables: survey response rate and survey cooperation rate.

TABLE S5. Variations across subpopulations in indicators of preventive health services recommended for both men and women.

SUBPOPULATIONS	Have Primary Care Physician	Always Received Needed Medical Care	Cholesterol Tested in Past 5 Years?	Flu Vaccine in Past Year?	Colonoscopy in 10 years
Population Restriction	None	None	None	None	Ages 50- 74
Years with Comparable Measurements	2002, 2003, 2004, 2007, 2008, 2009	2007, 2009, 2010, 2011	2002, 2005, 2007, 2010	2006, 2007, 2008, 2009, 2010, 2011	2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011
N	55,686	36,688	36,607	53,195	30,816
Total Population	79.0%	89.0%	78.8%	31.9%	59.0%
Sex					
Male	74.5%	89.3%	75.8%	30.3%	60.2%
Female	82.9%	88.7%	81.3%	33.3%	58.1%
P (Categorical)	<0.001	0.287	<0.001	<0.001	0.008
P (Categorical, svy adj.)	<0.001	0.148	<0.001	<0.001	0.005
Race					
White	86.2%	91.6%	84.5%	36.1%	61.7%
Black	81.4%	88.1%	77.8%	27.5%	58.7%
Hispanic	66.5%	85.3%	72.9%	29.0%	56.9%
Asian	76.5%	90.7%	73.5%	35.0%	52.2%
Other	77.7%	86.7%	76.0%	23.4%	51.0%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
Education					
<HS	68.1%	85.3%	71.6%	34.5%	56.1%
HS Grad	76.9%	89.0%	75.8%	31.4%	54.9%
Some College	80.5%	88.7%	78.6%	28.6%	57.4%
College Grad	84.1%	90.8%	83.8%	33.1%	64.1%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Linear, svy. adj.)	<0.001	<0.001	<0.001	0.459	<0.001
Age Group					
18-29	66.0%	86.5%	55.7%	21.1%	na
30s	74.7%	88.4%	75.9%	23.2%	na
40s	81.5%	87.7%	84.1%	26.1%	na
50s	85.2%	89.2%	89.7%	35.3%	51.9%
60s	89.7%	91.5%	93.0%	49.0%	65.7%
70s	91.9%	95.0%	94.7%	59.0%	67.8%
80+	91.7%	94.5%	91.5%	65.6%	na
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Linear, svy. adj.)	<0.001	<0.001	<0.001	<0.001	<0.001

SUBPOPULATIONS	Have Primary Care Physician	Always Received Needed Medical Care	Cholesterol Tested in Past 5 Years?	Flu Vaccine in Past Year?	Colonoscopy in 10 years
Nativity Status					
US Born	83.6%	90.0%	82.4%	34.6%	61.3%
Foreign Born	72.6%	87.6%	73.8%	28.5%	55.8%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
					(Cont'd)
Language Spoken at Home					
English	86.4%	89.7%	83.1%	32.8%	64.3%
Spanish	62.5%	85.4%	71.9%	29.0%	61.4%
Russian	81.5%	92.8%	83.7%	28.4%	55.8%
Chinese	82.2%	90.8%	78.8%	41.0%	62.1%
Indian	90.5%	87.8%	77.0%	36.1%	41.7%
Other	78.0%	86.9%	70.4%	25.2%	48.6%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
Marital Status					
Married	82.6%	91.5%	83.2%	33.8%	61.0%
Divorced/ Separated	80.8%	86.0%	84.4%	33.5%	57.4%
Widowed	89.6%	92.4%	91.0%	51.9%	59.0%
Never Married	73.3%	86.8%	68.4%	25.8%	54.2%
Couple	65.9%	86.3%	72.4%	26.5%	56.3%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
Employment Status					
Employed	79.8%	89.5%	78.9%	28.8%	59.0%
Self-Employed	70.2%	84.8%	76.6%	24.8%	54.6%
Unemployed >1yr	70.0%	83.0%	69.6%	27.1%	49.9%
Unemployed<1yr	66.7%	82.6%	67.9%	23.8%	48.2%
Homemaker	75.0%	89.4%	73.5%	32.3%	57.0%
Student	72.1%	90.9%	55.7%	28.0%	61.4%
Retired	91.6%	94.3%	93.1%	57.2%	66.8%
Disabled	83.7%	84.4%	85.9%	46.1%	57.5%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
Poverty Status					
<100% Poverty	70.7%	84.9%	72.9%	32.5%	54.9%
100-199%	77.3%	85.2%	76.2%	30.5%	54.0%
200-399%	84.4%	89.3%	82.1%	28.0%	60.0%
400+%	88.9%	93.3%	87.6%	33.5%	67.6%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Linear, svy. adj.)	<0.001	<0.001	<0.001	0.125	<0.001
Insurance					
Emp/Pr/S	87.6%	92.9%	85.0%	30.9%	62.4%
Medicare	90.3%	92.2%	89.4%	55.3%	66.5%
Medicaid	79.4%	86.7%	74.8%	31.7%	50.8%
Other	76.1%	90.1%	76.5%	35.4%	60.5%
Uninsured	43.0%	77.1%	56.3%	15.9%	37.9%
P (Categorical)	<0.001	<0.001	<0.001	<0.001	<0.001
P (Categorical, svy adj.)	<0.001	<0.001	<0.001	<0.001	<0.001

NOTE. Survey adjusted P values include controls for survey response rate, survey cooperation rate, and inclusion of "cell phone only" stratum.

na: not applicable.

TABLE S6. Variations across subpopulations in indicators of preventive health services recommended for women.

SUBPOPULATIONS	Mammogram in 2 years	Pap Smear in 3 yrs
Population Restriction	Females age 50-74	Females age 21-65
Years with Comparable Measurements	2002, 2004, 2005, 2006, 2007, 2008, 2009, 2010	2002, 2004, 2005, 2006, 2007, 2008, 2009, 2010
N	16,334	32,248
Total Population	80.8%	85.2%
Race		
White	78.6%	85.4%
Black	83.4%	90.1%
Hispanic	84.9%	86.5%
Asian	75.5%	67.8%
Other	74.1%	84.3%
P (Categor.)	<0.001	<0.001
P (Categor., svy adv.)	<0.001	<0.001
Education		
<HS	81.8%	81.8%
HS Grad	79.7%	83.8%
Some College	78.3%	85.9%
College Grad	82.6%	87.0%
P (Categor.)	0.001	<0.001
P (Categor., svy adv.)	0.001	<0.001
P (Linear, svy. adj.)	0.242	<0.001
Age Group		
18-29	na	79.6%
30s	na	89.0%
40s	na	88.1%
50s	79.2%	84.1%
60s	82.8%	81.8%
70s	81.0%	na
80+	na	na
P (Categor.)	<0.001	<0.001
P (Categor., svy adv.)	<0.001	<0.001
P (Linear, svy. adj.)	0.001	0.158
Nativity Status		
US Born	81.0%	88.1%
Foreign Born	80.5%	81.5%
P (Categor.)	> 0.500	<0.001
P (Categor., svy adv.)	> 0.500	<0.001
Language Spoken at Home		
English	79.9%	87.8%
Spanish	87.1%	86.5%
Russian	79.9%	74.5%
Chinese	77.1%	65.9%
Indian	71.6%	62.2%
Other	70.3%	69.9%
P (Categor.)	<0.001	<0.001
P (Categor., svy adv.)	<0.001	<0.001

(Cont'd)

SUBPOPULATIONS	Mammogram in 2 years	Pap Smear in 3 yrs
Marital Status		
Married	81.6%	87.0%
Divorced/ Separated	81.6%	86.6%
Widowed	82.2%	82.3%
Never Married	76.4%	81.8%
Couple	76.5%	88.6%
P (Categor.)	0.001	<0.001
P (Categor., svy adv.)	0.001	<0.001
Employment Status		
Employed	81.9%	87.6%
Self-Employed	76.4%	82.4%
Unemployed >1yr	78.0%	81.8%
Unemployed<1yr	74.6%	80.6%
Homemaker	78.5%	84.5%
Student	(a)	71.6%
Retired	82.7%	80.3%
Disabled	82.9%	83.2%
P (Categor.)	0.004	<0.001
P (Categor., svy adv.)	0.003	<0.001
Poverty Status		
<100% Poverty	79.6%	81.9%
100-199%	78.4%	84.1%
200-399%	78.5%	86.0%
400+%	82.9%	89.4%
P (Categor.)	0.001	<0.001
P (Categor., svy adv.)	0.001	<0.001
P (Linear, svy. adj.)	0.003	<0.001
Insurance		
Emp/Pr/S	83.1%	89.4%
Medicare	82.2%	80.9%
Medicaid	82.3%	84.5%
Other	83.2%	82.5%
Uninsured	61.0%	73.5%
P (Categor.)	<0.001	<0.001
P (Categor., svy adj.)	<0.001	<0.001

NOTE. Survey adjusted P values include controls for survey response rate, survey cooperation rate, and inclusion of "cell phone only" stratum.

(a) Not shown since only 37 women ages 50 to 74 responded to the mammogram question and also reported that they were students.

na: not applicable.

TABLE S7. Interaction analysis: Instances that reject (with p <0.05) the null hypotheses that annual rates of change in odds of use preventive health services are equivalent across subpopulations.

PREVENTIVE HEALTH INDICATOR	INTERACTING VARIABLE	CATEGORY	OVERALL ANNUAL EFFECT	INTERACTION EFFECT	COMPOSITE ANNUAL EFFECT	P Interaction
Has Primary Care MD	**Race**	White	1.116	1.000	1.116	0.010
		Black	"	1.045	1.166	
		Hispanic	"	1.009	1.126	
		Asian	"	1.070	1.194	
		Other	"	1.029	1.148	
	Health Insurance	Empl, Priv, Self	1.166	1.000	1.166	0.001
		Medicare	"	0.964	1.124	
		Medicaid	"	1.031	1.202	
		Other	"	1.060	1.236	
		None	"	0.960	1.119	
Always got care, 1 year	**Employment**	Employed	1.121	1.000	1.121	<0.001
		Self Employed	"	1.145	1.284	
		Unemploy>1 yr	"	1.053	1.180	
		Unemploy <1 yr	"	1.135	1.272	
		Homemaker	"	0.875	0.981	
		Student	"	1.400	1.569	
		Retired	"	0.924	1.036	
		Disabled	"	1.133	1.270	
Cholesterol test, 5 years	**Age in decades**	18-29	0.893	1.000	0.893	0.032
		30s	"	1.060	0.947	
		40s	"	1.016	0.907	
		50s	"	1.035	0.924	
		60s	"	1.048	0.936	
		70s	"	1.059	0.946	
		80s	"	1.097	0.980	
	Born in USA	No	0.986	1.000	0.986	0.006
		Yes	"	0.961	0.948	
	Language at home	English	1.031	1.000	1.031	0.002
		Spanish	"	1.012	1.043	
		Russian	"	1.220	1.258	
		Chinese	"	1.095	1.129	
		Indian	"	1.306	1.346	
		Other	"	0.896	0.924	
Flu Vaccination, 1 year	**Race - Ethnicity**	White	1.091	1.000	1.091	<0.001
		Black	"	1.068	1.165	
		Hispanic	"	1.094	1.194	
		Asian	"	1.134	1.237	
		Other	"	0.972	1.060	
	Age in decades	18-29	1.160	1.000	1.160	<0.001
		30s	"	0.994	1.153	
		40s	"	0.994	1.153	
		50s	"	0.993	1.152	
		60s	"	0.927	1.075	
		70s	"	0.898	1.042	
		80s	"	0.926	1.074	
	Born in USA	No	1.188	1.000	1.188	0.001
		Yes	"	0.942	1.119	

PREVENTIVE HEALTH INDICATOR	INTERACTING VARIABLE	CATEGORY	OVERALL ANNUAL EFFECT	INTERACTION EFFECT	COMPOSITE ANNUAL EFFECT	P Interaction
	Language at home	English	1.132	1.000	1.132	0.036
		Spanish	"	1.063	1.203	
		Russian	"	0.921	1.043	
		Chinese	"	1.055	1.194	
		Indian	"	0.938	1.062	
		Other	"	1.035	1.172	
	Marital Status	Married	1.163	1.000	1.163	0.001
		Divorced or Sep	"	0.969	1.127	
		Widowed	"	0.898	1.044	
		Never Married	"	0.988	1.149	
		Unmarried Couple	"	1.036	1.205	
	Employment	Employed	1.409	1.000	1.409	0.030
		Self Employed	"	1.017	1.433	
		Unemploy>1 yr	"	1.009	1.422	
		Unemploy <1 yr	"	0.980	1.381	
		Homemaker	"	1.137	1.602	
		Student	"	1.134	1.598	
		Retired	"	0.958	1.350	
		Disabled	"	1.006	1.417	
Colonoscopy, 10 years	**Race - Ethnicity**	White	1.109	1.000	1.109	0.001
		Black	"	1.055	1.170	
		Hispanic	"	1.047	1.161	
		Asian	"	1.072	1.189	
		Other	"	0.938	1.040	
	Born in USA	No	1.172	1.000	1.172	0.001
		Yes	"	0.953	1.117	
Mammogram, 2 years	**Marital Status**	Married	1.044	1.000	1.044	0.012
		Divorced or Sep	"	1.046	1.092	
		Widowed	"	0.938	0.979	
		Never Married	"	1.002	1.046	
		Unmarried Couple	"	0.923	0.964	
Pap Smear, 3 years	**Age in decades**	18-29	1.037	1.000	1.037	0.031
		30s	"	1.035	1.073	
		40s	"	0.995	1.032	
		50s	"	0.952	0.987	
		60s	"	0.970	1.006	
	Born in USA	No	1.091	1.000	1.091	< 0.001
		Yes	"	0.898	0.980	
	Health Insurance	Empl, Priv, Self	1.016	1.000	1.016	0.012
		Medicare	"	0.990	1.006	
		Medicaid	"	0.987	1.003	
		Other	"	1.109	1.127	
		None	"	1.066	1.083	

Note. P value is for test of the null hypothesis that annual change was equivalent across categories of the interacting variable. Estimates of composite annual effects and survey-adjusted p-values include controls for survey response rate, survey cooperation rate, and inclusion of "cell phone only" stratum.

SUPPORTING INFORMATION

Text S1 Disclaimer

The description of methods included in this article duplicates text that will be included in a parallel article that uses the same NYC-CHS data to study trends over time in non-specific psychological distress and its relationship to changes in macroeconomic conditions in New York City.

SUPPORTING INFORMATION

Text S2: Documentation for Variables Used in Analyses

Our analyses used data extracted from the annual New York City Community Health Surveys. Below we describe the variables extracted and the transformations, if any, made to the annual data to make it compatible for merging and analyses. We also note instances in which question wordings or response categories varied but we judged this variation to be substantively inconsequential.

Preventive Health Variables

Have a Primary Care Physician

Composite Variable: pcp_new

Source Variables: pcp (Years 2002, 2003, 2004)
Pcp07 (2007), pcp08 (2008), pcp09 (2009)

Wording Variations: None

Recodes for Analysis: Recoded as dummy variable: 1 for has primary care physician; 0 for does not have primary care physician

Cholesterol Tested in Past 5 Years

Composite Variable: chol_5yrs

Source Variables: cholesterol5yrs02 (2002)
cholesterol5yrs05 (2005)
cholesterol5yrs07 (2007)
cholesterol5yrs10 (2010)

Wording Variations: Response options differ over time. In 2002 the response choices were:
"1) Within the past year (1 to 12 months ago)
2) Within the past 2 years (1 to 2 years ago)
3) Within the past 5 years (2 to 5 years ago)
4) 5 or more years ago"

In 2005 and 2007 the choices were
"1) less than 12 months ago
2) 1 year ago but less than 2 years ago
3) 2 years ago but less than 5 years ago
4) 5 or more years ago"

In 2010 the choices were
"1) Less than 12 months ago
2) 1 year ago but less than 2 years ago
3) 2 years ago but less than 3 years ago
4) 3 years ago but less than 5 years ago
5) 5 or more years ago"

Recodes for Analysis: Response modifications did not affect the content of the variable. Recoded as a dummy variable: 1 = tested in past 5 years, or 0 = not tested..

Colonoscopy in Past 10 Years

Composite Variable: colon_10yr

Source Variables: colonoscopy10yr (Years 2003, 2004, 2006)
colonoscopy10yr05i (2005)
colonoscopy10yr07 (2007)
colonoscopy10yr08 (2008)
colonoscopy10yr09 (2009)
colonoscopy10yr10 (2010)
colonoscopy10yr11 (2011)

Wording Variations: Modification in response choices occurred over time. In 2003 and 2004 the response choices were
"1) Within the past year
2) Within the past 5 years
3) Within the past 10 years
4) More than 10 years ago."

In 2005 the choices were[1]
"1)Within the last 12 months
2) Greater than 12 months but less than 5 years
3) Between 5 years and 10 years
4) Greater than 10 years."

In 2006 the choices were
"1) Within the last 12 months
2) Greater than 12 months but less than 5 years
3) Between 5 years and 10 years
4) Greater than 10 years."

In 2007 the choices were
"1) Less than 1 year ago
2) 1 year ago but less than 5 years ago
3) 5 years ago but less than 10 years ago
4) 10 or more years ago."

[1] The questionnaire posted on the DOHMH website (accessed September 25, 2014) lists the 2005 categories as: "1) less than 12 months ago; 2) 1 year ago but less than 2 years ago; 3) 2 years ago but less than 3 years ago; 4) 3 years ago but less than 5 years ago; 5) 5 or more years ago." DOHMH staff has informed us that: "It looks like an incorrect version of the questionnaire was mistakenly posted to the website. There was an error in the response categories for that question that was identified partway through the survey. The response categories were changed to [those listed above] … Responses were imputed for participants who were asked the version with the incorrect categories if their original response was '5 or more years ago'; those were combined with the responses from participants who were asked the corrected version into the colonoscopy10yr05i variable (email from K. Johnson, DOHMH, September 25, 2014)."

Recodes for Analysis: Recoded as a dummy variable: Colonoscopy in past 10 years or not.

Mammogram in Past 2 Years

Composite Variable: mamo_2yr

Source Variables: mammogram2yr (Years 2002, 2004)
mammogram2yr05 (2005)
mammogram2yr06 (2006)
mammogram2yr07 (2007)
mammogram2yr08 (2008)
mammogram2yr09 (2009)
mammogram2yr10 (2010)

Wording Variations: Modification in response choices occurred in 2005.

In 2002 and 2004 the choices were:
"1)Within the past year (anytime less than 12 months ago)
2) Within the past 2 years (1 year but less than 2 years ago)
3) Within the past 3 years (2 years but less than 3 years ago)
4) Within the past 5 years (3 years but less 5 years ago)
5) 5 or more years ago"

From 2005-2010 the choices were:
"1) less than 12 months ago
2) 1 year ago but less than 2 years ago
3) 2 years ago but less than 3 years ago
4) 3 years ago but less than 5 years ago
5) 5 or more years ago"

Recodes for Analysis: No action was necessary since the response modifications did not affect the content of the variable. Recoded as a dummy variable: mammogram in past 2 years or not.

Pap Smear in Past 3 Years

Composite Variable: pap_3yr

Source Variables: paptest3yrall (Years 2002, 2004)
paptest3yrall05 (2005)
paptest3yrall06 (2006)
paptest3yrall07 (2007)
paptest3yrall08 (2008)
paptest3yrall09 (2009)
paptest3yrall10 (2010)

Wording Variations: Modification in response choices occurred in 2005.

In 2002 and 2004 the options were:
"1) Within the past year (anytime less than 12 months ago)
2) Within the past 2 years (1 year but less than 2 years ago)
3) Within the past 3 years (2 years but less than 3 years ago)
4) Within the past 5 years (3 years but less 5 years ago)
5) 5 or more years ago"

From 2005-2010 the options were:
"1) Less than 12 months ago
2) 1 year ago but less than 2 years ago
3) 2 years ago but less than 3 years ago
4) 3 years ago but less than 5 years ago, or
5) 5 or more years ago"

Recodes for Analysis: No action was necessary since the response modifications did not affect the content of the variable. Recoded as a dummy variable: had pap test in past 3 years or not.

Always Received Needed Medical Care

Composite Variable: alwaysgotcare12m - - Composite variable reversed coding of source variables (didntgetcare09, didntgetcare10, didntgetcare11)

Source Variables: didntgetcare09 (2009)
didntgetcare10 (2010)
didntgetcare11 (2011)

Wording Variations: None

Recodes for Analysis: Recoded as dummy variable **didntgetcare12m**: did or did not get care in past 12 months; **didntgetcare12m** was then recoded as a positive variable: **alwaysgetcare12m.**

Flu Vaccine in the Past Year

Composite Variable: flushot12m

Source Variables: fluvaccineshot (Years 2006-2011)

Wording Variations: Question modification took place over time.

From 2006-2009 the question asked "During the past 12 months, have you had a flu shot in your arm or a flu vaccine that was sprayed in your nose?" In 2010 and 2011 the question was "During the past 12 months, have you had a flu shot in your arm or a flu vaccine that was sprayed in your nose? **This question is only asking about SEASONAL or regular flu, not H1N1 or Swine Flu**" (emphasis added).

Recodes for Analysis: Was recoded as a dummy variable: 1= had a flu vaccination in past year, or 0 = not.

Socio-demographic and Other Variables

Marital Status

Composite Variable: newmarital

Source Variables: maritalstatus (Years 2002 to 2006)
maritalstatus07 (2007)
maritalstatus08 (2008)
maritalstatus09 (2009)
maritalstatus10 (2010)
maritalstatus11 (2011)

Wording Variations: From 2002 to 2006, response options were:
"1) married
2) divorced
3) widowed
4) separated
5) never married, OR
6) a member of an unmarried couple"

Beginning in 2007, the final response category was specified as: "6) Member of unmarried couple *living together."* (Emphasis added here – not in questionnaire.)

Recodes for Analysis: The two versions of response category 6 (with or without "living together") were treated as equivalent.[2] The original composite variable was N_Marital which was recoded into *newmarital* to combine the categories of separated and divorced.

Language Spoken at Home

Composite Variable: N_Lang_at_Home

Source Variables: athomelanguage05 (2005)
athomelanguage06 (2006)
athomelanguage07 (2007)
athomelanguage08 (2008)
athomelanguage09 (2009)
athomelanguage10 (2010)
athomelanguage11 (2011)

Wording Variations: Question wording in all years was: "What language do you speak most often at home?" Modification in response choices occurred in 2006.

In 2005 response options were:
"1) English
2) Spanish
3) Other (specify)"

[2] The percent of respondents choosing the "couple" response was not significantly different in the last two years (2005-06) using the original wording versus the first two years (2007-08) using the new wording (weighted estimates: 6.4% vs. 7.0%, p = 0.129).

From 2006-2011 response options were:
"1) English
2) Spanish
3) Russian
4) Chinese (includes Mandarin & Cantonese)
5) Indian (includes Hindi & Tamil)
6) Other"

Recodes for Analysis: The public use dataset for 2005 used the same coding categories as the questions asked in 2006 and later. We presume this was done by recoding the 2005 responses for the "Other (specify)" option. No further recoding was required.[3]

Employment Status

Composite Variable: N_Employ

Source Variables: employment07 (2007)
employment08 (2008)
employment09 (2009)
employment10 (2010)
employment11 (2011)

Wording Variations: Wording in all years was: "Are you currently…" followed by the response options
`
"1) employed for wages or salary
2) self-employed
3) a homemaker
4) a student
5) retired
6) unable to work
7) unemployed for 1 year or more
8) unemployed for less than 1 year"

Health Insurance Status

Composite Variable: N_Insure

Source Variables: insure02 (2002)
insure03 (2003)
insure04 (2004)
insure05 (2005)
insure06 (2006)
insure07 (2007)
insure08 (2008)
insure09 (2009)
insure10 (2010)
insure11 (2011)

Wording Variations: Question wording and response options changed over time.

[3] Minor but statistically significant differences (p = 0.020) were found in the weighted distribution of languages selected in 2005 vs. 2006: English (69.6% vs. 70.0%), Spanish (15.8% vs. 15.6%), Russian (2.2% vs. 2.9%), Chinese (3.4% vs. 3.8%), Indian (0.7% vs. 0.4%), Other (8.2% vs. 7.2%).

In 2002 the questions and options were: “What type of health care coverage do you use to pay for most of your medical care? Is it coverage through:
01) Your employer
02) Someone else's employer
03) A plan that you or someone else buys on your own
04) Medicare
05) Medicaid or Medical Assistance
07) Child Health Plus
08) Some other source, OR
88) Do you NOT have health coverage”

In 2003, 6 separate Yes/No questions were asked to determine health insurance status: “1. are you now PERSONALLY covered by…Private health insurance offered through a job or union? This could be insurance through a current job, a former job, your job or someone else’s job
2. Are you now PERSONALLY covered by… A private health insurance plan that you bought yourself
3. Are you now PERSONALLY covered by… Medicaid, Family Health Plus or some other type of state medical assistance for low-income people
4. Are you now PERSONALLY covered by… Medicare, the government program that pays health care bills for people over age 65 and for some disabled people
5. Are you now PERSONALLY covered by… Health insurance through ANY other source, including military or veteran’s coverage
6. Does this mean you personally have NO health insurance now that would cover your doctor or hospital bills”

From 2004 to 2006 the question and responses were
“What type of health care insurance do you use to pay for your doctor or hospital bills? Is it insurance through:
1) Your employer
2) Someone else's employer
3) A plan that you or someone else buys on your own
4) Medicare
5) Family Health Plus or Medicaid
6) The military, CHAMPUS, TriCare, or the VA
7) Some other source
88) None”

From 2007 to 2011 the question remained identical but the response options were modified over time. The option of “COBRA” was added in 2007 and all following years. In 2010 and 2011 the option “Family Health Plus or Medicaid” was modified to “Family Health Plus or Medicaid including Medicaid Managed Care”

Recodes for Analysis: Each year’s responses were recoded to categories: Employer, Private, or Self-Insured; Medicare; Medicaid; Other; Uninsured.

Age

Composite Variable:	age_decades
Source Variables:	demog1
Wording Variations:	None
Recodes for Analysis:	Recoded to combine age categories into 7 age range categories: 18-29, 30-39, 40-49, 50-59, 60-69, 70-79 and 80+

Poverty Status

Composite Variable:	newpovertygroup
Source Variables:	povertygroup
Wording Variations:	None
Recodes for Analysis:	Recoded to combine the categories 400 to <600% and 600% of poverty line and higher; “don’t know” category was dropped from analysis. Resultant categories were: < 100% of poverty line; 100% to < 200%; 200% to <400%; 400% and higher.

Sex

Composite Variable:	female
Source Variables:	sex
Wording Variations:	Beginning in 2005 question wording was modified. From 2002 to 2004, the question was” Are you...” and was only asked if there was only one adult in the household and sex was not recorded in household enumeration. Afterwards it was modified to “Because it is sometimes difficult to determine over the phone, I am asked to confirm with everyone . . . Are you male or female?”
Recodes for Analysis:	Recoded as a dummy variable for female: 1 = female; 0 = male.

Race

Source Variables:	newrace
Wording Variations:	None
Recodes for Analysis:	None. Response categories are: White, Black, Hispanic, Asian & Pacific Islander; Other.

Education

Source Variables:	education
Wording Variations:	None
Recodes for Analysis:	None. Response categories are: less than high school; high school graduate; some college or technical school; college graduate.

Nativity Status

Source Variables:	usborn
Wording Variations:	None
Recodes for Analysis:	Recoded as a dummy variable: 1 for U.S. born; 0 for not U.S. born.

SUPPORTING INFORMATION

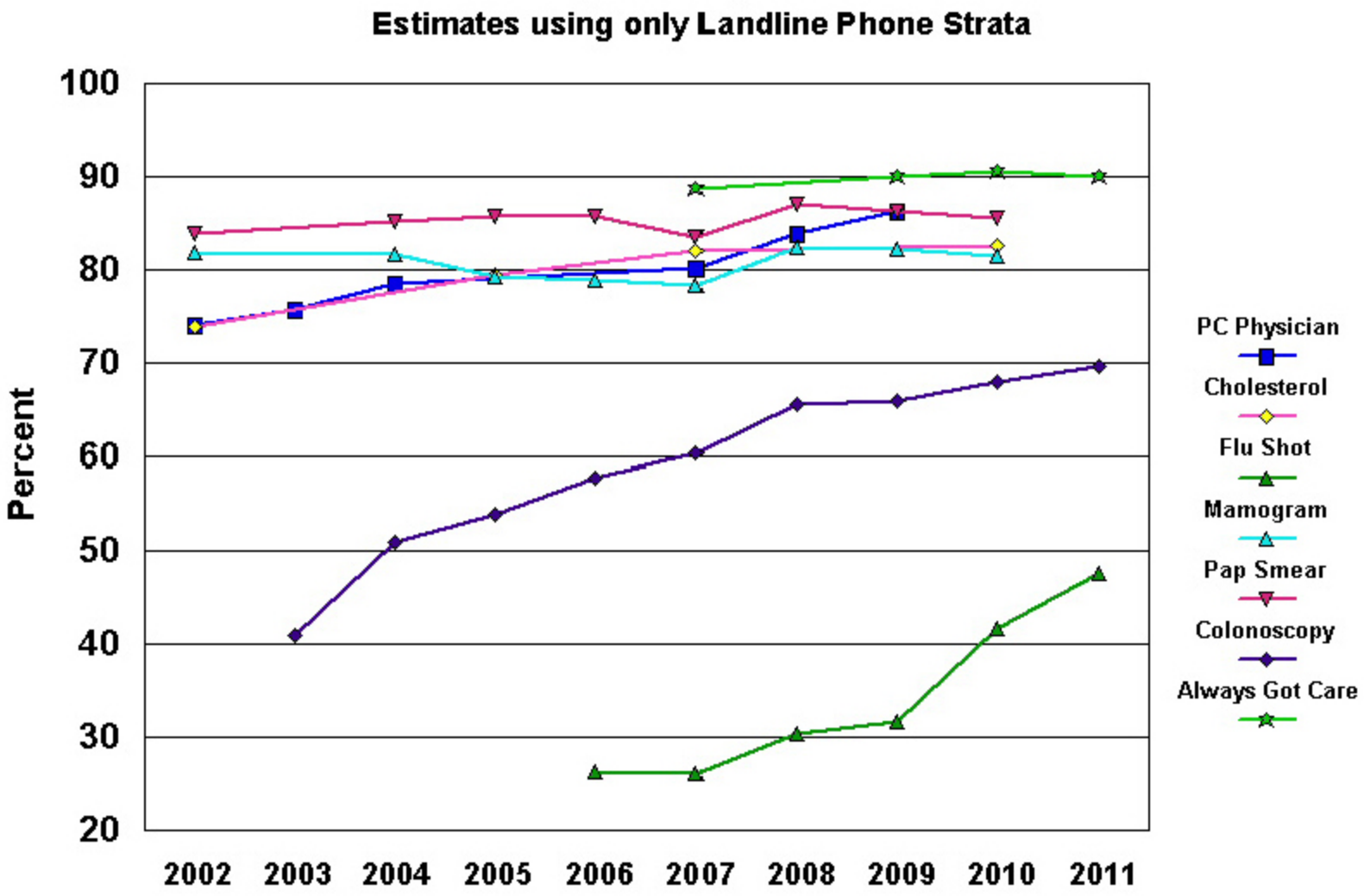
Text S3 Interview Languages

According to a DOHMH report on the 2002 to 2007 surveys: “The CHS was originally conducted by Baruch [College, CUNY] in English, Spanish, Russian, Mandarin, Greek, Yiddish, Polish, Haitian Creole, and Korean in 2002.” In subsequent years: “The survey [was] programmed into CATI for both English and Spanish and paper copies of the Mandarin and Russian translations [were] used by bilingual interviewers and entered into the English CATI program. The CATI program tracks the language that is used for each survey. Additionally, a small number of interviews are conducted in other languages using live interpreter services provided by Language Line Services. Language Line Services is able to provide interpreting services for 170 languages. **SOURCE:** For the 2002 to 2007 surveys: Community Health Survey Methodology Report, January 2008, New York City Department of Health and Mental Hygiene, Department of Health and Mental Hygiene, Bureau of Epidemiology Services, Survey Unit. For Abt/SRBI surveys in 2008 and later years: New York City Department of Health and Mental Hygiene Community Health Survey 2008 Methods, report dated 2010.

SUPPORTING INFORMATION

Text S4 IRB Exemption for Analyses of Public Use Data

In 2013, the Director of Research Compliance for the City University of New York wrote: "[University] HRPP/IRB review is required for research that involves human subjects in which CUNY is engaged. Human subjects are defined by our policy and the regulations as: A living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information. Based on this definition, if the data you are accessing is truly publicly available, i.e. not restricted with password nor requirement for permission before use, then it doesn't meet the definition of human subject and a HRPP/IRB review is not required (Email on April 9, 2013 from Farida Lada, University Director for Research Compliance, The City University of New York)."


Estimates using only Landline Phone Strata
Percent
100
90
80
70
60
50
40
30
20
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
PC Physician
Cholesterol
Flu Shot
Mamogram
Pap Smear
Colonoscopy
Always Got Care