Surveillance of seasonal influenza vaccination coverage among health care personnel in the United States

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Background

- CDC uses influenza vaccination coverage data to:
  - Monitor impact of vaccination programs
  - Identify groups in need of vaccination services

- **Health Care Personnel (HCP)** are a special population targeted for vaccination
  - Routine vaccination of HCP can help reduce influenza-related illness among HCP and in health care settings
Survey sample challenge

- Probability-based population surveys can be costly and time-consuming:
  - Low prevalence of HCP in the total U.S. population
  - Difficult to survey sufficient numbers in the short time frame of interest (mid- and end-of-season)
Survey sample challenge

Healthcare providers 8.8%

- Physicians and surgeons 0.6%
- Registered nurses 2.0%
- Physician assistants <0.1%
- Nurse practitioners and midwives <0.1%

Detailed Census Occupation by Sex and Race/Ethnicity for Residence Geography
Universe: Civilian labor force. 2006-2010 (5-year ACS data)
What about existing surveillance systems?

- Data from existing systems are not always available before the start of the next influenza season
- Limited **in-depth information** for vaccine-related K-A-B-B
  - Knowledge
  - Attitudes
  - Behaviors
  - Barriers
Solution: Internet panel source

- Practical solution used since 2009-10 influenza season

- Internet panel survey overview:
  - Respondents identified from internet panels with HCP members
  - Non-probability sample
  - Efficient (time and cost)
  - Representative sample vs. “reflective sample”
    By design, looks like HCP population
Methodology – Large Internet panels

- Professional HCP from WebMD
  >2.5 million U.S. HCP members
  - Physicians, nurse practitioners, physician assistants, nurses, dentists, pharmacists, allied health professionals, technicians, and technologists

- Other HCP occupations from Survey Sampling International
  >1 million U.S. households (general population)
  - Assistants, aides, administrators, clerical support workers, janitors, food service workers, and housekeepers

- Participants invited using email and pop-up intercept
  - Some quotas imposed, no probability selection used
Methodology – Web survey

- Self-administered online questionnaire

- Sample \((n \sim 1,900)\) recruited from panels twice per year
  - Early (November) and end (April) of each influenza season
  - Sampled with replacement across surveys
    - Duplicates possible but rare (<3% overlap)
  - Data used to generate coverage estimates for influenza season
Methodology – Data weighting

- Post-stratification raking procedure
- National HCP benchmark estimates for each occupation category by characteristics associated with vaccination

  - HCP occupations (10 categories)
  - Health care work settings (Hospital, Long-term care, Ambulatory care)

Current Population Survey
  - Race/ethnicity (black non-Hisp, Hispanic, white and other non-Hisp)
  - Gender (M,F)
  - Age (<35, 35-44, 45-54, 55-64, ≥ 65)
  - Census region (NE, MidW, S, W)
Methodology – Limitations

- No confidence intervals calculated (non-probability sample!)
- Statistical testing not done
- ±5 percentage points used as “notable difference”
Methodology – Comparisons

- Compare Internet panel results to a probability-based survey

- Reference Survey

The National Health Interview Survey (NHIS)
# Comparison: Internet Panel vs. NHIS

<table>
<thead>
<tr>
<th></th>
<th>Internet panel survey</th>
<th>NHIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recruitment method</strong></td>
<td>Non-probability sample from volunteer Internet panel</td>
<td>Complex sampling design with stratification, clustering, and multistage sampling</td>
</tr>
<tr>
<td><strong>Survey mode</strong></td>
<td>Self-administered online</td>
<td>In-person interview</td>
</tr>
<tr>
<td><strong>Timing of vaccination</strong></td>
<td>During influenza season (July – April)</td>
<td>Within past 12 months*</td>
</tr>
<tr>
<td><strong>Geographic level</strong></td>
<td>National</td>
<td>National</td>
</tr>
<tr>
<td><strong>Data collection schedule</strong></td>
<td>Nov. and April each influenza season</td>
<td>Monthly</td>
</tr>
<tr>
<td><strong>Timeliness of reporting</strong></td>
<td>2 weeks</td>
<td>16 months</td>
</tr>
<tr>
<td><strong>Typical completion/response rate</strong></td>
<td>90% completion rate</td>
<td>61% - 66% response rate</td>
</tr>
<tr>
<td><strong>Approx. sample size</strong></td>
<td>&gt;1,900 per survey per season</td>
<td>2,000 per survey (different HCP definition)</td>
</tr>
</tbody>
</table>

* Since 2005, can determine whether vaccinated during influenza season
Methodology – HCP definition

Internet panel survey

Works* in any of the following

- Hospital
- Physician’s office or other non-hospital setting, such as a medical clinic or other ambulatory care setting
- Dentist office or dental clinic
- Pharmacy
- Nursing home, assisted living facility, or other long-term care facility
- Home health agency or home health care
- Other health care setting

Or does work involving direct care of patients

*Note: “volunteers” not systematically excluded but not directly addressed

NHIS

Currently volunteers or works in

- Hospital
- Medical clinic
- Doctor’s office
- Dentist’s office
- Nursing home
- Some other health-care facility

Includes part-time/unpaid work in a facility or in-home nursing care
Comparison of demographics – Internet panel survey (IPS) vs. NHIS

Final weighted distribution of age groups in HCP sample
2011-12 influenza season,
Internet Panel Survey vs. NHIS, United States

- IPS
- NHIS

<table>
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<tr>
<th>Age group (years)</th>
<th>IPS</th>
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<tbody>
<tr>
<td>18-29</td>
<td>15.1</td>
<td>21.6</td>
</tr>
<tr>
<td>30-44</td>
<td>34.5</td>
<td>31.1</td>
</tr>
<tr>
<td>45-59</td>
<td>39.7</td>
<td>32.0</td>
</tr>
<tr>
<td>60+</td>
<td>10.6</td>
<td>15.3</td>
</tr>
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</table>
Comparison of demographics – Internet panel survey (IPS) vs. NHIS

Final weighted distribution of education level in HCP sample
2011-12 influenza season
Internet Panel Survey vs. NHIS, United States

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<th>Education level</th>
<th>Percent of sample</th>
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<tr>
<td>HS or less</td>
<td>IPS 51.7%</td>
</tr>
<tr>
<td></td>
<td>NHIS 63.1%</td>
</tr>
<tr>
<td>College degree</td>
<td>IPS 26.7%</td>
</tr>
<tr>
<td></td>
<td>NHIS 20.6%</td>
</tr>
<tr>
<td>More than college</td>
<td>IPS 21.7%</td>
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<tr>
<td></td>
<td>NHIS 16.3%</td>
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Comparison of demographics – Internet panel survey (IPS) vs. NHIS

Final weighted distribution of racial/ethnic groups in HCP sample
2011-12 influenza season,
Internet Panel Survey vs. NHIS, United States

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<tr>
<td>Hispanic</td>
<td>10.6</td>
<td>10.8</td>
</tr>
<tr>
<td>white, non-Hisp</td>
<td>66.7</td>
<td>68.4</td>
</tr>
<tr>
<td>black, non-Hisp</td>
<td>13.4</td>
<td>13.1</td>
</tr>
<tr>
<td>other</td>
<td>9.3</td>
<td>7.7</td>
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Estimated Influenza Vaccination Coverage HCP, 1996-2013

* Methodology used in the NHIS to estimate influenza vaccination coverage among HCP changed during the 2005-06 season
Estimated Influenza Vaccination Coverage among HCP, 2009-2013

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<tr>
<th>Influenza Season</th>
<th>NHIS</th>
<th>Internet Panel</th>
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<tr>
<td>2009-10</td>
<td>57.5</td>
<td>63.4</td>
</tr>
<tr>
<td>2010-11</td>
<td>55.8</td>
<td>63.5</td>
</tr>
<tr>
<td>2011-12</td>
<td>62.4</td>
<td>66.9</td>
</tr>
<tr>
<td>2012-13</td>
<td>72.0</td>
<td></td>
</tr>
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Vaccination coverage by age – Internet panel survey (IPS) vs. NHIS

2011-12 influenza season,
Internet Panel Survey vs. NHIS

Age group (years) | % vaccinated (IPS) | % vaccinated (NHIS)
--- | --- | ---
18-29 | 63.9 | 55.7
30-44 | 68.8 | 55.9
45-59 | 63.8 | 62.4
60+ | 75.7 | 78.0
Vaccination coverage by race/ethnicity – Internet panel survey (IPS) vs. NHIS

2011-12 influenza season, Internet Panel Survey vs. NHIS

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Vaccination coverage by education – Internet panel survey (IPS) vs. NHIS

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<td>80.1</td>
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Summary: Internet Panel Survey (IPS) Results vs. NHIS

- IPS sample
  - More prime career ages (between 30 and 59)
  - More “college or higher” educated

- IPS results appear **higher** vaccination coverage vs. NHIS
  - Overall, higher by 5-6 percentage points
  - Higher for persons under age 45
  - Higher for Hispanic and black non-Hispanic HCPs

- Although higher, overall vaccination coverage trend over time **tracks similar to NHIS**
Summary: Internet Panel Survey (IPS) Results vs. NHIS

Higher IPS estimates may be attributable to:

- More educated sample
- More information seekers being online – more informed
- Exclusion of HCPs without Internet access
- Differential self-selection bias to elect to take/complete survey
HCP Internet Panel Assessment

- **Strengths**
  - Efficiently captures and reflects the rare HCP occupation group
  - Useful for timely early- and late-season evaluation of vaccination coverage
  - Provides information on vaccination-related K-A-B-B unobtainable from existing population-based surveys
  - Vaccination coverage trends appear to track similarly as NHIS

- **Weaknesses**
  - Non-probability sample subject to known (e.g., higher educated) and unknown bias
  - No theoretical basis for calculating population variances and CIs
  - Lack of empirically validated studies to date
HCP Internet Panel Limitations

- Internet panel sample not randomly selected from the population of U.S. HCP; despite weighting, results may not be representative

- Possible variation in panel recruitment over time

- Results based on self-report

- Vaccination rates may be inflated from true coverage

- No confidence intervals can be constructed for population estimates

- Statistical tests on population estimates not possible because of lack of variance estimations
HCP Internet Panel Conclusions

- A cost-effective surveillance tool
- Obtained early vaccination and KABB data
  
  *Do not know if KABB data are valid or fit for purpose*
- Further weighting adjustments might be explored to calibrate with NHIS
- Validation research and exploration of population variance approximations should be pursued
- Continue to support probability and non-probability approaches to monitor vaccination coverage among low-prevalent populations
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Thank You!

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The findings and conclusions in this presentation are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.
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