Assessment of Plumbing Code Enforcement in the United States

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Introduction

Health Risks

Health and Safety
Introduction

Health Risks
  - Known
  - Health Risks

Theoretical Mitigation Measures

Health and Safety
Introduction

Health Risks

- Known
- Health Risks

Theoretical Mitigation Measures

Codes and Regulations

Health and Safety
Introduction

Health Risks
- Known Health Risks

Theoretical Mitigation Measures

Codes and Regulations

Compliance

Enforcement

Health and Safety
Introduction

Health Risks

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Codes and Regulations

- Compliance
- Enforcement

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Introduction

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Theoretical Mitigation Measures

Codes and Regulations

Compliance

Enforcement

State and local governments

Health and Safety
Outline

- State plumbing code enforcement regimes
  - Dimensions of state code enforcement
  - Categorization of code enforcement regimes
- Local plumbing code enforcement official survey
  - Capacity
  - Effort
  - Strategies
Dimensions of State Code Enforcement

- Type of plumbing code
- Local enforcement role
- Local discretion
- Standardization of local enforcement
- State review of local enforcement
- State revocation of local enforcement
Dimensions of State Code Enforcement

- Type of plumbing code
  1. No code
  2. Enabling code
  3. Mandatory statewide code
Dimensions of State Code Enforcement

- Local Enforcement Role
  1. State delegates to local government on an individual basis
  2. Broad authorization of local code enforcement
  3. Mandatory local enforcement
Dimensions of State Code Enforcement

- Local discretion: How local code enforcement agencies are permitted to amend the state code
  1. Prohibited
  2. Can make more stringent with state permission
  3. Can amend to suit local conditions with state permission
  4. Can amend the code or adopt a different code without state permission
Dimensions of State Code Enforcement

- Local Standardization
  1. No particular requirements
  2. State prescription of requirements for personnel certification, allowable enforcement actions, record-keeping, and other administrative procedures
Dimensions of State Code Enforcement

- State Review
  1. No state review of local enforcement
  2. Review process of vague frequency
  3. Reviews initiated based on complaints to state officials
  4. Mandatory, regular/periodic reviews
Dimensions of State Code Enforcement

- State Revocation
  1. State reserves right to revoke authority of local agencies to conduct inspections and issue permits
  2. No mention
Dimensions of State Code Enforcement

• State Revocation
  1. State reserves right to revoke authority of local agencies to conduct inspections and issue permits
  2. No mention
U.S. State Plumbing Code Enforcement Regimes

1. **Minimalist:** No state code or enforcement requirements

2. **Enabling:** State adopts a plumbing code that local governments may amend without permission

3. **Mandatory:** State has mandatory statewide code and disallows local amendments or requires permission, and may enforce codes directly

4. **Standardized:** Like mandatory states, but also standardize local enforcement programs

5. **Energetic:** Like standardized, but periodically review, and may revoke, local enforcement programs
Nationally Representative Plumbing Enforcement Official Survey

- Asked about enforcement practices, agency capacity, effort expended on different activities, perceived compliance
- ~2500 Agencies selected with probability proportional to population of jurisdiction
- Each response weighted according to this probability
U.S. State Plumbing Code Enforcement Regimes

Labeled with number of survey responses out of total (380)

Regime
- Minimalist
- Enabling
- Mandatory
- Standardized
- Energetic

[Map showing distribution of plumbing code enforcement regimes across the U.S.]
Plumbing Code Enforcement Body

- No Code: 2%
- Code adopted, not enforced: 0.4%
- County: 1%
- State: 2%
- Private Contractor: 6%
- Municipal Department (Respondent): 89%
Self-Reported Effort by Activity

- Inspection
- Plan Checking
- Technical Assistance
- Public Awareness
- Surveillance
- Legal Prosecution

Survey-Weighted Percentage

- None
- A Little
- Some
- A Lot
- A Great Deal
<table>
<thead>
<tr>
<th>Action by Agency</th>
<th>Frequency</th>
<th>Survey-Weighed Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notice of Violation</td>
<td>0.8</td>
<td>1</td>
</tr>
<tr>
<td>Stop-Work Order</td>
<td>0.9</td>
<td>0.89</td>
</tr>
<tr>
<td>Fine for working without permit</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Revocation of a permit</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Field Citation/ fine</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Misdemeanor prosecution/ fine</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Notice of Collective Action</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Fine for not follow code provision</td>
<td>0.2</td>
<td>0.2</td>
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<tr>
<td>Revocation of Certificate of Occupancy</td>
<td>0.1</td>
<td>0.1</td>
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<tr>
<td>Fine for not following plan</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Temporary Restraining Order</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Preliminary Injunction</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Permanent Injunction</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Deterrent Action by Agency Frequency**
Fieldwork standardization of Inspection and Regulation Activities

Survey Weighted Proportion

- Inspection checklists
- Inspector required to consult supervisor on hard calls
- Annual inspector performance evaluation
- Periodic inspector work review
- Followup inspections of inspector work
- Agency manual
- Intensive inspector policy training
- Rotation of inspector territory
- Use of productivity measures
Discretionary Actions by Inspectors

- Spend extra time on site to develop good relations
- Badger contractors who are chronic offenders
- Can be lenient when life safety not threatened
- Relax standards based on extenuating circumstances
- Authorized to bluff
Incentive Actions by Enforcement Officials

- Concerted effort to be cordial
- Prior record taken into account in prosecution decision
- Attitude taken into account in prosecution decision
- Any other incentive
- Less frequent inspections for firms with good records
- Modification of standards for firms with good records
Technical Assistance Actions by Enforcement Staff

Survey Weighted Proportion

- One-on-one assistance at site
- Booklets describing code enforcement procedures
- One-on-one assistance during plan review
- Workshops to explain code provisions
- Newsletters
- Self-contained multimedia packages
## Factor Analysis

<table>
<thead>
<tr>
<th>Action Category</th>
<th>Systematic Philosophy</th>
<th>Facilitative Philosophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deterrent</td>
<td>0.55</td>
<td>0.28</td>
</tr>
<tr>
<td>Standardization</td>
<td>0.66</td>
<td>0.14</td>
</tr>
<tr>
<td>Discretion</td>
<td>0.08</td>
<td>0.58</td>
</tr>
<tr>
<td>Incentives</td>
<td>0.24</td>
<td>0.64</td>
</tr>
<tr>
<td>Technical Assistance</td>
<td>0.53</td>
<td>0.13</td>
</tr>
</tbody>
</table>
Cluster Analysis

Agency Strategy

- Facilitative
- Accomodative
- Strict
- Energetic
Survey-Weighted Agency Strategy Distribution

- Facilitative: 33%
- Accomodative: 48%
- Energetic: 11%
- Strict: 8%
<table>
<thead>
<tr>
<th>State Regime</th>
<th>Accommodative</th>
<th>Facilitative</th>
<th>Strict</th>
<th>Energetic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimalist</td>
<td>0.04</td>
<td>0.0357</td>
<td>0.002</td>
<td>0.007</td>
<td>0.0847</td>
</tr>
<tr>
<td>Enabling</td>
<td>0.0603</td>
<td>0.0669</td>
<td>0.0059</td>
<td>0.0144</td>
<td>0.1475</td>
</tr>
<tr>
<td>Mandatory</td>
<td>0.0943</td>
<td>0.0629</td>
<td>0.0261</td>
<td>0.0508</td>
<td>0.2341</td>
</tr>
<tr>
<td>Standardized</td>
<td>0.1132</td>
<td>0.0968</td>
<td>0.0374</td>
<td>0.0075</td>
<td>0.2549</td>
</tr>
<tr>
<td>Energetic</td>
<td>0.1725</td>
<td>0.0704</td>
<td>0.0067</td>
<td>0.0293</td>
<td>0.2789</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>0.4803</strong></td>
<td><strong>0.3327</strong></td>
<td><strong>0.0781</strong></td>
<td><strong>0.109</strong></td>
<td><strong>1</strong></td>
</tr>
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The table and graph in the document illustrate the distribution of compliance ratings across different local strategies. The graph shows the density of compliance ratings on a scale from 0 to 10, with a peak at a rating of 9-10.

### Local Strategy Table

<table>
<thead>
<tr>
<th>Compliance</th>
<th>Accommodative</th>
<th>Facilitative</th>
<th>Strict</th>
<th>Energetic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;80%</td>
<td>0.4485</td>
<td>0.2669</td>
<td>0.077</td>
<td>0.1044</td>
<td>0.8968</td>
</tr>
<tr>
<td>&lt;80%</td>
<td>0.0545</td>
<td>0.047</td>
<td>0.0018</td>
<td>0</td>
<td>0.1033</td>
</tr>
</tbody>
</table>
Senior Enforcement Official Perception of Capacity

- Authority
- Technical Expertise
- Adequacy of staff levels
- Adequacy of non-personnel budget

Survey-Weighted Percentage
Survey: Logistic regression

Number of strata = 1    Number of obs = 223
Number of PSUs = 223    Population size = 956.24677
Design df = 222
F(4, 219) = 1.26
Prob > F = 0.2868

| Variable   | Odds Ratio | Std. Err. | t    | P>|t| | [95% Conf. Interval] |
|------------|------------|-----------|------|-----|---------------------|
| Q14_1      | .5746191   | .2550187  | -1.25| 0.213| .2396305            | 1.377901 |
| Q14_2      | 2.887707   | 1.529891  | 2.00 | 0.047| 1.016528            | 8.203268 |
| Q14_3      | .8621996   | .4217327  | -0.30| 0.762| .3288308            | 2.260701 |
| Q14_4      | .5105017   | .2544239  | -1.35| 0.179| .1911832            | 1.363153 |
| _cons      | .6706524   | .9807752  | -0.27| 0.785| .0375717            | 11.97111 |
Relative Frequency of Perceived Reasons for Violations

Deliberate Noncompliance (Intentional)

Negligence (Intentional)

Organizational Problems

Technical Problems

Survey Weighted Percentages

- Never
- Rarely
- Sometimes
- Often
- Always
Backflow-Prevention Enforcement Responsibility

- Building Code/Permitting Department: 52%
- Another Department (Water Utility, Health Dept, Fire Dept): 45%
- Private Contractor: 1%
- Not enforced: 2%
Backflow Prevention Enforcement Actions

Survey-Weighted Proportions

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

0.4
0.5
0.6
0.7
0.8
0.9
1.0

0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

Inspection During Construction
During Plan Review
Inspection for Plumbing Modifications
Periodic, Regular Inspections
Relative Frequency of Backflow Violations

- Failure to submit required documentation
- Failure to maintain backflow assemblies
- Failing to test backflow assemblies
- Unprotected Cross-Connection

Survey Weighted Percentages

- Never
- <10%
- 10%-30%
- 30%-50%
- 50%-70%
- 70%-90%
- >90%
- 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Conclusions

- Wide variability in plumbing code enforcement practices at state and local levels

- Generally high perceived compliance rates

- Future research should explore the relationship between regulatory strategy, perceived compliance, and water quality outcomes
Acknowledgements

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