

Portland State University

PDXScholar

---

Institute on Aging Publications

Institute on Aging

---

2021

# Survey Deficiencies as Quality Indicators in Oregon Assisted Living Communities

Ozcan Tunalilar

Portland State University, tozcan@pdx.edu

Sunny C. Lin

Portland State University, sunlin@pdx.edu

Paula C. Carder

Portland State University, carderp@pdx.edu

Follow this and additional works at: [https://pdxscholar.library.pdx.edu/aging\\_pub](https://pdxscholar.library.pdx.edu/aging_pub)



Part of the [Gerontology Commons](#), [Inequality and Stratification Commons](#), and the [Medicine and Health Commons](#)

Let us know how access to this document benefits you.

---

## Citation Details

Tunalilar, Ozcan; Lin, Sunny C.; and Carder, Paula C., "Survey Deficiencies as Quality Indicators in Oregon Assisted Living Communities" (2021). *Institute on Aging Publications*. 101.

[https://pdxscholar.library.pdx.edu/aging\\_pub/101](https://pdxscholar.library.pdx.edu/aging_pub/101)

This Pre-Print is brought to you for free and open access. It has been accepted for inclusion in Institute on Aging Publications by an authorized administrator of PDXScholar. Please contact us if we can make this document more accessible: [pdxscholar@pdx.edu](mailto:pdxscholar@pdx.edu).

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Title:** Survey Deficiencies as Quality Indicators in Oregon Assisted Living Communities

For Peer Review

## Abstract

### Background and Objectives

License inspection data have commonly been used as a quality measure for nursing homes but has not yet been used to assess the quality of assisted living/residential care (AL/RC) communities. We use deficiency citations to examine the quality of AL/RC communities in Oregon and identify structural and environmental characteristics associated with inspection results.

### Research Design and Methods

Using data from 526 licensed AL/RC communities in Oregon that received a license inspection visit between 2008 and 2016, we examined the prevalence of deficiency citations by type and year. We then estimated regression models to identify structural and environmental characteristics associated with the number of deficiency citations.

### Results

Most (64%) inspections resulted in at least one deficiency citation. The most common citations were medications and treatments (57%), change of condition and monitoring (48%), and resident health services (45%). Several structural characteristics were associated with higher odds of receiving one or more deficiency citations, including: larger size, memory care designation, rural location, longer administrative tenure, and for-profit status. Environmental characteristics associated with higher odds of receiving one or more deficiency citations included: rural location, low unemployment, and market concentration. The number and likelihood of a given community receiving a deficiency citation decreased over time.

### Discussion and Implications

1  
2  
3 As measured by number of deficiency citations, AL/RC quality is associated with higher  
4 risk of exposure, longer institutional knowledge, greater resource availability, and  
5 market pressure. These results demonstrate that license inspection data are a viable  
6 option for assessing the quality of AL/RC communities.  
7  
8  
9  
10  
11  
12  
13

14 *Keywords:* long-term care, quality of care, deficiency citations, license inspections  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For Peer Review

## Background and Objectives

Older adults who have chronic health conditions and physical or cognitive impairments often rely on a variety of long-term services and supports (LTSS), including assisted living and residential care (AL/RC) communities. In 2016, there were over 800,000 AL/RC residents, and over half were aged 85 or older (52 percent), received assistance with bathing (64 percent) and walking/locomotion (57 percent), nearly half received help with dressing (48 percent), and 42 percent had a diagnosis of Alzheimer's disease or a related dementia (Harris-Kojetin et al., 2019). The number of AL/RC residents with cognitive impairment is estimated at 7 out of 10 (Zimmerman et al., 2014). These statistics indicate that significant numbers of this population are vulnerable due to physical frailty and cognitive impairment.

The quality of LTSS provided to older adults and persons with physical and cognitive impairments has long been a topic of concern among researchers and policymakers (Institute of Medicine, 2001; Kane, 2001; Mueller, 2002). Within the nursing facility sector, survey deficiencies have commonly been used as a quality measure (Castle, 2010; Castle & Ferguson, 2010; Li et al., 2015). Like nursing homes, AL/RCs are licensed and subject to regulatory enforcement and oversight. While the need to assess quality in the AL/RC setting has been described (Hawes & Phillips, 2007; Zimmerman et al., 2005), few studies have done so using survey deficiencies, possibly because states are responsible for the licensing, enforcement, and oversight of these settings (Smith et al., 2021). Fortunately, existing state administrative records, such as deficiencies and consumer complaints, can be used to understand quality in AL/RCs. To date, only two studies have used such data. One found that specialty

1  
2  
3 licenses (e.g., mental health, dementia care) and region were associated with the  
4 number of deficiencies received by AL/RC in Florida (June et al., 2019). An Arizona-  
5 based study of complaint records found that facility-level risk factors were associated  
6 with substantiated allegations of mistreatment, including larger size and national  
7 corporate ownership (associated with for-profit status), but not resident-level risk factors  
8 (Phillips & Guo, 2011).  
9  
10  
11  
12  
13  
14  
15

### 16 *Rationale*

17  
18  
19 The gap in knowledge about AL/RC deficiencies and consumer complaints, and  
20 their relationship to resident health outcomes, has serious ramifications for the health,  
21 safety, and overall well-being of thousands of older adult residents in the U.S. The U.S.  
22 Government Accountability Office (GAO, 2018) reported that states lack methods for  
23 overseeing and reporting neglect, abuse, exploitation, and other critical incidents in  
24 these settings.  
25  
26  
27  
28  
29  
30  
31  
32

33 Our study draws on resource dependency theory, which posits that  
34 organizational performance is dependent on the ability of an organization to navigate its  
35 external environment (Pfeffer & Salancik, 2003). Specifically, resource dependency  
36 theory suggests that certain AL/RC characteristics may be associated with AL/RC  
37 quality if these characteristics impact the ability of organizations to attract, attain, and  
38 manage vital resources in its environment. For example, rural AL/RC may have lower  
39 quality if they have difficulty attracting and retaining sufficient staffing levels or specific  
40 categories of staff (e.g., licensed nurse, administrator).  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50

### 51 *Study Objectives*

52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 The overall objective of this research is to advance our understanding of the  
4 relationship between survey deficiencies and quality in AL/RC settings. To do this, we  
5 analyze multiple years of administrative records to examine whether deficiencies were  
6 associated with certain AL/RC characteristics. Specifically, we examine structural  
7 characteristics that relate to an AL/RC's internal resources and capabilities, and  
8 environmental characteristics that capture an AL/RC's external resources and  
9 pressures.  
10  
11  
12  
13  
14  
15  
16  
17  
18

19 Our contribution to the literature is threefold. First, we extend previous work on  
20 the use of deficiency data and AL/RC quality in Florida (June et al., 2019) and Arizona  
21 (Phillips and Guo, 2011) to Oregon, a state recognized as a pioneer in the AL/RC model  
22 of LTSS (Eckert et al., 2009; Frytak et al., 2001). Second, we provide proof of concept  
23 of how important and novel system and process measures can be used to assess  
24 AL/RC quality. Finally, we move beyond cross-sectional analysis by using longitudinal  
25 data to examine the incidence of survey deficiencies over time. In addition, we include  
26 as a variable multiple enforcement visits rather than only the most recent visit as was  
27 done by prior authors (June et al., 2019).  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39

## 40 **Research Design and Methods**

### 41 *Study Design*

42 This study employed panel data to understand correlates of deficiency citations.  
43  
44 The analytic sample included 526 AL/RCs that received at least one licensing visit  
45 between 2008 and 2016. We examined whether the quality of an AL/RC, as measured  
46 by the number of deficiency citations, varies with key internal and environmental factors  
47 (e.g. ownership, size, urban/rural location) that may enhance or inhibit the ability of an  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 AL/RC to achieve and maintain high quality services. We then used resource  
4  
5 dependency theory to explain why these characteristics are associated with  
6  
7 performance, and make policy recommendations to target those organizations that may  
8  
9 need additional support in achieving high quality care.  
10

### 11 *Data Sources*

12  
13  
14 We received AL/RC inspection (“survey”) results conducted by the Oregon  
15  
16 Department of Human Services (ODHS), which licenses two setting types, assisted  
17  
18 living and residential care communities, either of which might receive ODHS approval to  
19  
20 be designated as “memory care” (MC) communities. State surveyors conduct  
21  
22 unannounced inspection surveys at least every 24 months. The state conducts different  
23  
24 types of surveys during the operating cycle of a facility (e.g., initial licensure, re-license,  
25  
26 in response to complaints, and revisits and follow-up). Each rule violation (hereafter,  
27  
28 deficiency citation) is recorded as a separate incident in the survey team’s report  
29  
30 alongside the deficiency type.  
31  
32  
33  
34

35  
36 Although we received data from all visits, we use data for visits that occurred  
37  
38 between January 2008 and December 2016 because this was a stable period in terms  
39  
40 of regulatory action. Specifically, sweeping changes occurred in 2007 and again in 2018  
41  
42 when an omnibus quality of care bill (House Bill 3359) was adopted. During the study  
43  
44 period, there were 1,826 initial or re-licensing visits to 526 AL/RC communities. Seven  
45  
46 AL/RC were excluded because they were open only briefly or opened in late 2016 and  
47  
48 did not receive any visits. Out of 526 AL/RCs, 430 (82 percent) had opened prior to the  
49  
50 study period (before 2008) with a median operating time of 8.7 years prior to 2008.  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 Data on the AL/RC environment comes from the Area Health Resource File  
4 (AHRF) and the US Bureau of Labor Statistics (BLS). Except for the unemployment  
5 rate, all environmental characteristics were pulled from the AHRF for all available study  
6 years and assigned based on the AL/RC's county. Since some variables from the US  
7 census are not collected annually, missing information was carried forward from  
8 previous years' data. Annual data on county unemployment rate was collected from the  
9 BLS.  
10  
11  
12  
13  
14  
15  
16  
17  
18

### 19 *Variables*

20  
21 AL/RC organizational characteristics include the number of years the AL/RC was  
22 open at time of the visit, size (in number of beds), administrator tenure (in years),  
23 market share, license type, whether the AL/RC had a contract to serve Medicaid  
24 residents, and non-profit status. We also included survey year as a control variable.  
25 Unless otherwise noted, variables were measured for each year.  
26  
27  
28  
29  
30  
31  
32

33 ***Number of years in operation.*** We calculated the number of years that each AL/RC  
34 was open as of the last inspection date by subtracting the year of the visit by the year  
35 the AL/RC opened.  
36  
37  
38

39  
40 ***Size.*** We used licensed capacity to create a 5-category measure (0-24, 25-49, 50-74,  
41 75-99, and 100 and more) as a measure of AL/RC size.  
42  
43

44 ***Administrator tenure.*** We measured this variable by subtracting each administrator's  
45 job start date from the survey visit date. It was top-coded at 8 years due to  
46 measurement issues for a subset of AL/RC (115 out 1,826 cases) as ODHS records do  
47 not go back before 2000 for all facilities.  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 **Market share.** Market share was calculated as the number of AL/RC beds divided by  
4  
5 the total number of AL/RCs beds in the county multiplied by 100 to achieve a  
6  
7 percentage point scale from 0-100. For ease of interpretation, in our models we  
8  
9 operationalized this variable as the highest quartile (17-100%) versus the bottom 3  
10  
11 quartiles (0-17%).  
12  
13

14 **License type.** As discussed above, Oregon uses two license categories (assisted living  
15  
16 and residential care). In addition to this base license, a community can receive  
17  
18 endorsement to provide Alzheimer's care. Some communities use all their available  
19  
20 beds for this purpose while others combine regular AL/RC beds with MC units (e.g., as  
21  
22 a wing or floor). Using licensing information, we created a 4-category measure of  
23  
24 community type (0 = AL (non-MC); 1 = RC (non-MC); 2 = standalone MC; and 3 =  
25  
26 mixed/combined).  
27  
28  
29

30 **Medicaid contract.** This is a binary indicator for whether the AL/RC has a contract to  
31  
32 serve Medicaid beneficiaries and get reimbursed for these services.  
33  
34

35 **Non-profit status.** We retrieved for-profit/non-profit information about the AL/RC  
36  
37 owners from the Oregon Secretary of State website. We assigned all but non-profit  
38  
39 corporations as for-profit companies (e.g., business corporations, limited liability  
40  
41 companies, and limited and general partnerships).  
42  
43

44  
45 The environment variables that we examined in our analysis examine whether  
46  
47 the AL/RC is located in a county with the following characteristics: rural status (0  
48  
49 =metropolitan, 1=rural, 2=micropolitan), the number of certified skilled nursing facility  
50  
51 (SNF) beds, share of older adults in the population, percent persons in poverty, percent  
52  
53 of persons unemployed, percent Medicare population also eligible for Medicaid (dual  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 eligible), and a proxy measure of market competition. Unless otherwise noted, variables  
4  
5 were measured for each year. Data on older adult population, poverty, unemployment,  
6  
7 and dual eligibility was only available for 2010-2016. Therefore, in our models, we  
8  
9 assumed that 2008-2009 data for the variable were the same as 2010. To test how  
10  
11 sensitive our models were to these assumptions, we ran sensitivity analyses excluding  
12  
13 2008-2009. As results were not sensitive to this exclusion, they are not shown here (see  
14  
15 Supplemental Materials).  
16  
17

18  
19 **Rural.** We used 2018 Core Based Statistical Area (CBSA) codes from the Area Health  
20  
21 Resource File to determine whether the AL/RC county was located in an metropolitan  
22  
23 (urban area with a population of 50,000 or more), micropolitan (urban area with a  
24  
25 population of 10,000-50,000), or rural area (all other areas).  
26  
27

28  
29 **Number of Certified SNF beds.** We used data from the Nursing Home Compare public  
30  
31 use files to determine the number of total certified beds in skilled nursing facilities in the  
32  
33 county.  
34

35  
36 **Percent older adult population.** We use census data from the Area Health Resource  
37  
38 File to determine the percent of county population ages 65 or higher. For ease of  
39  
40 interpretation, in our models we operationalized this variable as the highest quartile (18-  
41  
42 34%) versus the bottom 3 quartiles (10-18%).  
43

44  
45 **Percent poverty.** We use census data from the Area Health Resource File to determine  
46  
47 the percent of county population that were living in poverty. For ease of interpretation, in  
48  
49 our models we operationalized this variable as the highest quartile (19-39%) versus the  
50  
51 bottom 3 quartiles (9-19%).  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 **Percent unemployment.** We use census data from the Area Health Resource File to  
4 determine the percent of county population that were unemployed. For ease of  
5 interpretation, in our models we operationalized this variable as the highest quartile (10-  
6 18%) versus the bottom 3 quartiles (4-10%).  
7  
8  
9

10  
11  
12 **Percent Medicare population eligible for Medicaid.** We use Medicare data from the  
13 Area Health Resource File to determine the percent of Medicare beneficiaries in the  
14 county that were dually eligible for Medicaid. For ease of interpretation, in our models  
15 we operationalized this variable as the highest quartile (23-29%) versus the bottom 3  
16 quartiles (9-23%).  
17  
18  
19  
20  
21  
22  
23

24 **Market Competition.** We calculated market competition using the Herfindahl-  
25 Hirschman Index (HHI) of residences' beds in the county. HHI allows us to characterize  
26 competition within a county on a scale of perfect competition (HHI = 0) to monopoly  
27 (HHI = 1). For ease of interpretation, we characterized market competition into  
28 categories by using quartiles as follows: most competitive (0.03 - 0.05), moderately  
29 concentrated (2<sup>nd</sup> and 3<sup>rd</sup> quartiles of HHI; 0.06-0.22), and highly concentrated including  
30 monopolistic (0.22-1.00).  
31  
32  
33  
34  
35  
36  
37  
38  
39

#### 40 *Statistical Analysis*

41  
42 To describe the analytic sample, we calculated means (continuous variables) and  
43 percentages (categorical variables) of our AL/RC organizational and environmental  
44 characteristics. We then examined the distribution of the number of citations across  
45 years and the reasons behind deficiency citations, and compared inter-residence  
46 variation with between-residence variation to understand whether the quality of a AL/RC  
47 is a long-term characteristic of these communities or more transient over time.  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 To understand how AL/RC organizational and environmental characteristics are  
4 associated with probability of receiving a citation and number of citations, we ran two  
5 models. First, we estimated multilevel mixed-effects logistic regression models for the  
6 likelihood of having at least one deficiency as the outcome, and organizational and  
7 environmental characteristics as the covariates. Then, we estimated multilevel mixed-  
8 effects Poisson regression models to analyze the relationship between the total number  
9 of deficiency citations that a residence received during each visit as the outcome, and  
10 organizational and environmental characteristics as the covariates. To account for  
11 repeated measures from AL/RC and the resulting clustering, in both sets of models, we  
12 included community-level random intercepts (Rabe-Hesketh and Skrondal, 2012). All  
13 analyses were conducted using Stata (version 16, Stata Corp.).  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27

28 To test the sensitivity of our models to our treatment of missing census data from  
29 2008-2009, we re-ran our models using only 2010-2016 data. To test the sensitivity of  
30 our model to overdispersion, we re-ran our Poisson model using a mixed-effects  
31 negative binomial regression model. Finally, to test the sensitivity of our model to  
32 correlation of environmental variables, we ran our models excluding number of SNF  
33 certified beds in the county, which was moderately correlated with percent of Medicare  
34 beneficiaries eligible for Medicaid (correlation coefficient 0.68) and market competition  
35 (correlation coefficient -0.73). The extent to which the main findings are sensitive to  
36 these changes is discussed in the Results section.  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48

## 49 **Results**

### 50 *Survey Visits and Deficiency Citations*

51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Data on 1,826 inspections for 526 AL/RC were included in our analysis.  
4

5 Description of survey deficiencies per visit over time are presented in Table 1. Most  
6 visits, or 79 percent, received at least one deficiency citation, and the average number  
7 of deficiencies per visit was 5.2 (SD=5.0). During the nine-year study window, the  
8 average number of visits per AL/RC was 3.5, ranging from 1 to 5 (not shown in table).  
9  
10 Out of 526 AL/RC included in the study, most received four (58 percent; n=305) or five  
11 (7 percent; n=37) visits; 46 (9 percent) received only one visit, 39 (7 percent) received  
12 two visits, and 99 (19 percent) received three visits.  
13  
14

15 [Table 1 About Here]  
16  
17

18 We next examine the prevalence of a subset of deficiency citations for licensing  
19 visits that remained consistent during this period. These citations were coded as 0 if  
20 none was received and 1 if at least one was received in the subcategory. Figure 1  
21 presents the prevalence of these specific citations, in descending order. Most licensing  
22 visits (69%) resulted in at least one citation out of three most common citations:  
23 medications and treatments (57%), change of condition and monitoring (48%), or  
24 resident health services (45%).  
25  
26

27 [Figure 1 About Here]  
28  
29

### 30 *Community Characteristics*

31

32 Characteristics of AL/RC inspected during survey visits are presented in Table 2.  
33 Of interest, 21.5 percent of AL/RC were designated for MC. Most AL/RC (77.9%) had a  
34 contract to provide services to Medicaid residents and receive reimbursement. A small  
35 share (10.6%) were non-profit. Most (77.6%) were serving metropolitan communities. In  
36 bivariate analyses, those that received no deficiency citations were significantly different  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 from those that received at least one deficiency in terms of size, license type, Medicaid  
4 contract, administrator tenure, non-profit status, market share, and county  
5 unemployment (see Table 2).  
6  
7  
8

9  
10 [Table 2 About Here]  
11

### 12 *Multivariable Analysis*

13

14  
15 To estimate an unconditional intraclass correlation (ICC), we estimated an empty  
16 (without any covariates) multilevel mixed-effects logistic regression model for the  
17 likelihood of receiving at least one deficiency during a visit. The estimated ICC was .26,  
18 indicating that a quarter of the variance (26 percent) in the likelihood of receiving at  
19 least one deficiency citation was due to the between-facility variability. As such, AL/RCs  
20 differed in their likelihood of receiving at least one deficiency citation more over time  
21 (within-facility variance) than compared to other AL/RCs (between-facility variance).  
22  
23  
24  
25  
26  
27  
28  
29

30  
31 We next examined the correlates of receiving at least one deficiency from a  
32 licensure visit (Table 3, Model 1). The likelihood of receiving at least one citation  
33 decreased over time. Larger AL/RC, MC designated, and AL/RC located in rural areas  
34 had a higher likelihood of receiving at least one deficiency citation compared to their  
35 counterparts. AL/RC managed by administrators with longer tenure, as well as non-  
36 profit AL/RC and those located in counties with high unemployment had a lower  
37 likelihood of receiving at least one deficiency citation.  
38  
39  
40  
41  
42  
43  
44  
45

46 [Table 3 About Here]  
47  
48

49 Then, we examined the correlates of number of deficiency citations received  
50 during licensure visits (Table 3, Model 2). The average number of deficiency citations  
51 received significantly decreased over time. Larger AL/RC, MC designated, rural AL/RC,  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 and AL/RC in highly concentrated AL/RC markets had a higher expected number of  
4 deficiency citations compared to smaller AL/RC, those with AL base license only,  
5 metropolitan and micropolitan AL/RC, and AL/RC located in competitive markets,  
6 respectively. AL/RC with longer administrative tenure, non-profit AL/RC, and AL/RC in  
7 counties with high unemployment had a lower expected number of deficiency citations.  
8  
9  
10  
11  
12  
13

14 To illustrate the significant effects of covariates on deficiency citations, we  
15 calculated the estimated number of citations using coefficients from the full mixed-  
16 effects Poisson model, holding all other covariates at their means. For instance, AL/RC  
17 with a licensed capacity of 6-24 beds had an expected 3.7 citations compared to 8.8 for  
18 AL/RC with 100+ beds. AL had an expected 4.5 citations on average compared to 5.8  
19 for RC, 6.0 for MC, and 6.5 for AL/RCs that have a mixed license. AL/RC with an  
20 administrator of less than 1 year had an expected 5.6 citations compared to 4.5 citations  
21 for AL/RC with an administrator of more than 8 years. For-profit AL/RC had an expected  
22 5.5 citations compared to 3.3 citations for non-profit AL/RC. Rural AL/RC had an  
23 expected 9.4 citations, micropolitan AL/RC had an expected 4.8 deficiency citations,  
24 and metropolitan AL/RC had an expected 5.2 deficiency citations. Finally, AL/RC in the  
25 most competitive and moderately concentrated counties had an expected 4.4 and 5.2  
26 citations, respectively, and AL/RC located in the most highly concentrated counties had  
27 an expected 6.3 citations.  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45

#### 46 *Sensitivity Analysis*

47  
48  
49 Results from sensitivity analyses that re-ran our models using only 2010-2016  
50 data suggests that our results were not sensitive to the way we imputed missing data  
51 from 2008-2009 (Supplemental Table 1). Similarly, our main results were held in the  
52  
53  
54  
55  
56  
57  
58  
59  
60



1  
2  
3 sensitivity analysis that used a mixed-effects negative binomial regression model,  
4 suggesting that our results were not impacted by overdispersion (Supplemental Table  
5 2). Effect sizes and confidence intervals were similar with two small differences. In the  
6 mixed-effects negative binomial model accepting Medicaid was statistically significantly  
7 associated with more deficiency citations (IRR: 1.23, 95% CI: 1.08, 1.41 compared to  
8 IRR: 1.12, 95% CI: 0.95, 1.32 in the mixed-effects Poisson model) and AL/RC located in  
9 moderately concentrated markets had significantly more deficiency citations (IRR: 1.25,  
10 95% CI: 1.07, 1.45 compared to IRR: 1.17, 95% CI: 0.99, 1.40 in the mixed-effects  
11 Poisson model). Finally, results from our sensitivity analyses that excluded the number  
12 of SNF certified beds (which was moderately correlated with percent of Medicare  
13 beneficiaries dually eligible for Medicaid, and market competition) suggest that  
14 collinearity did not substantially alter our main results (Supplemental Table 3).  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29

### 30 **Discussion and Implications**

31  
32  
33 In this study, we examined organizational and environmental factors associated  
34 with survey deficiency citations in AL/RC communities licensed in Oregon. To our  
35 knowledge, this study is the first to use longitudinal data to examine regulatory  
36 deficiencies in AL/RC communities. Information about state approaches to regulatory  
37 enforcement and consumer protections in these settings is lacking, as indicated by a  
38 recent U.S. GAO Report (2019). The current study provides a state-level example that  
39 other researchers can model.  
40  
41  
42  
43  
44  
45  
46  
47  
48

49 Several findings are comparable to research on nursing home deficiency  
50 citations. Specifically, as with our findings, smaller facility size and non-profit status  
51 (Castle et al., 2010; Mullan and Harrington, 2001) as well as longer nursing home  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 administrator tenure (Castle, 2001) are associated with fewer nursing home citations.  
4  
5 Unlike nursing home research (Castle et al., 2010), presence of a Medicaid contract in  
6  
7 Oregon AL/RC was not significantly associated with presence or the number of  
8  
9 deficiency citations. However, the presence of a Medicaid contract does not mean that  
10  
11 these AL/RC have any, or many, current Medicaid beneficiaries. For example, a 2018  
12  
13 survey of 524 AL/RC in Oregon found that while 79% reported having a Medicaid  
14  
15 contract, only 42% of AL/RC residents were current Medicaid beneficiaries (Carder et  
16  
17 al., 2018).  
18  
19

20  
21 Our finding that deficiency ratings are not stable within AL/RC over time suggests  
22  
23 that deficiency citations may not be stable or long-term indicators of quality at a  
24  
25 particular AL/RC, but rather serve as a snapshot. In other words, there may be no low-  
26  
27 quality facilities, but only facilities that are low-quality at a certain time, at least when  
28  
29 measured using this indicator. This underscores the importance of regular updates to  
30  
31 consumer-facing websites that include information about survey visit results such as  
32  
33 deficiencies.  
34  
35

36  
37 Our study suggests several general mechanisms associated with regulatory  
38  
39 deficiencies, including risk of exposure, institutional knowledge, resource availability,  
40  
41 and market pressure. We briefly discuss each mechanism below.  
42  
43

44 **Exposure.** The risk that an AL/RC will be exposed to a regulatory deficiency may be  
45  
46 associated with organizational characteristics such as larger size, license type, and  
47  
48 resident profile. Having more residents (e.g., larger facility size) may increase the risk of  
49  
50 adverse events captured in deficiency citations, or the regulatory gaze might be higher  
51  
52 in larger communities, as survey teams spend more time and make more repeat visits  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 to these communities. MC communities may also be subject to greater risk given the  
4 considerably higher acuity among MC residents. As in other states (Carder, 2017), MC  
5 in Oregon must meet the AL/RC requirements, in addition to other regulatory  
6 requirements that could increase the odds of receiving a deficiency. Specifically, MC  
7 must have building design features (e.g., controlled egress) and staff trained in  
8 dementia care. However, the staffing level for AL/RC and MC is the same (e.g.,  
9 sufficient to meet resident needs), as are care planning and admission/discharge  
10 requirements. Our findings about license type suggest that residential mix may also be  
11 associated with regulatory deficiencies. Although we do not explicitly examine resident-  
12 level data in this study, we can infer information about resident profiles based on license  
13 type. Specifically, prior research suggest that MC residents receive assistance with  
14 more activities of daily living compared to AL or RC residents, and a larger percentage  
15 of RC residents have a diagnosed serious mental illness (SMI), compared to AL and  
16 MC residents (Carder et al., 2018). These or other observable differences between  
17 licensure classifications might sensitize surveyors' attention to specific deficit areas if,  
18 for example, they have experienced the need to apply more stringent criteria on behalf  
19 of vulnerable residents, such as those with dementia or SMI.

20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42 ***Institutional Knowledge.*** Institutional knowledge might account for the increased risk  
43 of regulatory deficiencies. For example, longer-employed administrators might have  
44 greater experience and knowledge of AL/RC policies and practices as well as greater  
45 familiarity with their staff and residents. Longer tenure is associated with staff stability in  
46 nursing homes (Castle, 2001). It is possible that administrators of AL/RC communities  
47 that receive deficiency citations might leave employment, either voluntarily or not  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 (Geletta & Sparks, 2013). This mechanism is supported by our finding that future survey  
4 year is associated with lower odds of regulatory deficiencies. It may be that  
5 communities improve their quality of care over time because of increased institutional  
6 knowledge. Alternatively, communities may be becoming better at avoiding deficiency  
7 citations (i.e. “playing the game” or “teaching to the test”).  
8  
9

10  
11  
12  
13  
14 **Resource Availability.** We found that non-profit and urban communities have fewer  
15 deficiency citations, suggesting that AL/RC settings with more resources may have  
16 greater ability to address and prevent deficiency citations. Non-profit communities may  
17 be able to invest more resources into their facilities than for-profit communities, which  
18 are beholden to stakeholder interests. Rural location was also statistically associated  
19 with increased citation deficiencies, possibly because rural communities may have less  
20 access to a qualified labor force compared to metropolitan communities. Both non-profit  
21 and rural communities may have more access to unique funding opportunities such as  
22 government grants.  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34

35 **Market Pressure.** Finally, market pressure may influence the attention and effort that  
36 communities invest into facility quality. We found that higher market concentration was  
37 associated with lower numbers of deficiency citations. This suggests that increased  
38 market pressure for filling the beds may provide external motivation for communities to  
39 improve the quality of care provided. However, this type of market pressure may also be  
40 a challenge for some AL/RC, as this could create pressure to lower profit margins to  
41 unsustainable levels – although our results do not support that conclusion.  
42  
43  
44  
45  
46  
47  
48  
49  
50

51 *Limitations of the Current Study*  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 This study has limitations that must be considered with study findings. First, this  
4 is a single state study, therefore findings from this study may not be generalizable to  
5 communities outside of Oregon. To date there has been no national data on regulatory  
6 compliance in AL/RC communities, and because of the paucity of research on AL/RC  
7 regulatory deficiencies, we believe this study contributes to the literature and provides  
8 proof of concept for other states to follow. Future research could utilize similar datasets  
9 in other states, building on this study as a template for how to leverage multiple waves  
10 of survey data. Second, measurement error may limit our study findings. Specifically,  
11 the administrator tenure variable, derived from public records, might not capture the  
12 exact date of transfer from one administrator to another, especially if the same  
13 management company was retained. Finally, our study is associational, not causal. We  
14 cannot say with certainty that the characteristics we identified were *causes of* survey  
15 deficiencies. This has certain implications for our study. First, we cannot rule out  
16 reverse causality. For instance, administrators that did not receive deficiency citations in  
17 previous surveys may be more likely to stay on their jobs (instead of longer-tenured  
18 administrators receiving lower number of citations). Second, it is possible that  
19 unmeasured factors simultaneously influenced our dependent and independent  
20 variables. For example, policy changes during the study period may influenced the risk  
21 of receiving a specific deficiency citation for certain types of communities. We  
22 addressed this by focusing only on policies that did not change during the study period.  
23 Future analyses could control for time to account for policy changes. Another example  
24 relates to community ownership. In our sample, we found that community ownership  
25 changed frequently over time; around 10% of owners changed in 3 years. However, due  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 to data limitations we were unable to reliably examine this relationship. Future research  
4  
5 could examine how ownership changes influence other organizational characteristics.  
6

7  
8 *Conclusion*  
9

10 This study underscores a potential role for utilizing survey deficiency citations in  
11  
12 constructing measures of quality for the AL/RC sector and cautions for adjusting such  
13  
14 measures of quality for resident mix and structural factors. Our findings also highlight  
15  
16 the need for future research to empirically establish links between deficiency citations  
17  
18 and resident outcomes. For example, how does deficiency data correlate with important  
19  
20 outcomes such as residents' experiences of quality and potential elder abuse, person-  
21  
22 centeredness, or aspects of care delivery, such as meals, assistance with personal care  
23  
24 tasks, and oversight of medical conditions? Considering the potential for real-time  
25  
26 availability of AL/RC inspection results, informative value of deficiency citations data for  
27  
28 differentiating across AL/RC, and their observed sensitivity to market characteristics  
29  
30 such as competition, ensuring public access to these data may improve LTSS provided  
31  
32 to AL/RC consumers.  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## References

- 1  
2  
3  
4  
5  
6 Carder, P. C. (2017). State Regulatory Approaches for Dementia Care in Residential  
7  
8 Care and Assisted Living. *The Gerontologist*, gnw197.  
9  
10 <https://doi.org/10.1093/geront/gnw197>  
11  
12 Carder, P.C., Tunalilar, O., Elliott S., & Dys, S., (2018). 2018 Resident and Community  
13  
14 Characteristics Report: Portland, OR: Portland State University. Institute on  
15  
16 Aging. Available at: [https://www.pdx.edu/institute-on-](https://www.pdx.edu/institute-on-aging/sites/g/files/znldhr3046/files/2020-07/2018_CBC_AnnualReport_AL-RC-MC.pdf)  
17  
18 [aging/sites/g/files/znldhr3046/files/2020-07/2018\\_CBC\\_AnnualReport\\_AL-RC-](https://www.pdx.edu/institute-on-aging/sites/g/files/znldhr3046/files/2020-07/2018_CBC_AnnualReport_AL-RC-MC.pdf)  
19  
20 [MC.pdf](https://www.pdx.edu/institute-on-aging/sites/g/files/znldhr3046/files/2020-07/2018_CBC_AnnualReport_AL-RC-MC.pdf)  
21  
22  
23  
24 Castle, N. G. (2001). Administrator turnover and quality of care in nursing homes. *The*  
25  
26 *Gerontologist*, 41(6), 757-767.  
27  
28  
29 Castle, N. G., Wagner, L. M., Ferguson, J. C., & Handler, S. M. (2010). Nursing Home  
30  
31 Deficiency Citations for Safety. *Journal of Aging & Social Policy*, 23(1), 34–57.  
32  
33 <https://doi.org/10.1080/08959420.2011.532011>  
34  
35  
36 Castle, N. G., & Ferguson, J. C. (2010). What Is Nursing Home Quality and How Is It  
37  
38 Measured? *The Gerontologist*, 50(4), 426–442.  
39  
40  
41 Castle, N. (2011). Nursing home deficiency citations for abuse. *Journal of Applied*  
42  
43 *Gerontology*, 30(6), 719-743. <https://doi.org/10.1177/0733464810378262>  
44  
45  
46 Eckert, J.K., Carder, P.C., Morgan, L.A., Frankowski, A.C., Roth, E. (2009). Inside  
47  
48 Assisted Living. Johns Hopkins University Press.  
49  
50 Frytak, J. R., Kane, R. A., Finch, M. D., Kane, R. L., & Maude-Griffin, R. (2001).  
51  
52 Outcome trajectories for assisted living and nursing facility residents in Oregon.  
53  
54 *Health Services Research*, 36(1 Pt 1), 91.  
55  
56  
57  
58  
59  
60

1  
2  
3 Geletta, S., & Sparks, P. J. (2013). Administrator turnover and quality of care in nursing  
4 homes. *Annals of Long Term Care*, 21(6).

5  
6  
7  
8 Government Accountability Office. (2018). Medicaid Assisted Living Services: Improved  
9 Federal Oversight of Beneficiary Health and Welfare Is Needed. (GAO  
10 Publication No. 18-179). Washington, D.C.: U.S. Government Printing Office.

11  
12  
13  
14 Government Accountability Office. (2019). Elder Abuse: Federal Requirements for  
15 Oversight in Nursing Homes and Assisted Living Facilities Differ. (GAO  
16 Publication No. 19-599). Washington, D.C.: U.S. Government Printing Office.

17  
18  
19 Harris-Kojetin L, Sengupta M, Lendon JP, Rome V, Valverde R, Caffrey C. Long-term  
20 care providers and services users in the United States, 2015–2016. National  
21 Center for Health Statistics. *Vital Health Stat* 3(43). 2019.

22  
23  
24  
25  
26  
27  
28 [https://www.cdc.gov/nchs/data/series/sr\\_03/sr03\\_43-508.pdf](https://www.cdc.gov/nchs/data/series/sr_03/sr03_43-508.pdf)

29  
30  
31 Hawes C, & Phillips CD. (2007). Defining quality in assisted living: comparing apples,  
32 oranges, and broccoli. *Gerontologist*, 47, 40–50.

33  
34  
35  
36 [https://doi.org/10.1093/geront/47.supplement\\_1.40](https://doi.org/10.1093/geront/47.supplement_1.40)

37  
38 House Bill 3359, 79th Oregon Legislative Assembly, 2018 Reg. Sess. (Oregon, 2018).

39  
40 Available at

41  
42  
43  
44  
45 <https://olis.leg.state.or.us/liz/2017R1/Downloads/MeasureDocument/HB3359/Enrolled>

46  
47 Institute of Medicine (US) Committee on Improving Quality in Long-Term Care.  
48 Improving the Quality of Long-Term Care. Wunderlich GS, Kohler PO, editors.  
49 Washington (DC): National Academies Press (US); 2001. PMID: 25077221.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



- 1  
2  
3 June, J. W., Meng, H., Dobbs, D., & Hyer, K. (2019). Using Deficiency Data to Measure  
4  
5 Quality in Assisted Living Communities: A Florida Statewide Study. *Journal of*  
6  
7 *Aging & Social Policy*, 1-16. <https://doi.org/10.1080/08959420.2018.1563471>  
8  
9
- 10 Kane, R. A. (2001). Long-Term Care and a Good Quality of Life: Bringing Them Closer  
11  
12 Together. *The Gerontologist*, 41(3), 293. <https://doi.org/10.1093/geront/41.3.293>  
13  
14
- 15 Li, Y., Harrington, C., Temkin-Greener, H., You, K., Cai, X., Cen, X., Mukamel, D.  
16  
17 (2015). Deficiencies in care at nursing homes and racial/ethnic disparities across  
18  
19 homes fell, 2006-11. *Health Affairs*, 34 (7), 1139-1146.  
20  
21 <https://doi.org/10.1377/hlthaff.2015.0094>  
22  
23
- 24 Mueller, C. (2002). Quality Care in Nursing Homes: When the Resources Aren't There.  
25  
26 *Journal of the American Geriatrics Society*, 50(8), 1458–1460.  
27  
28 <https://doi.org/10.1046/j.1532-5415.2002.50373.x>  
29  
30
- 31 Mullan JT, Harrington C. Nursing Home Deficiencies in the United States: A  
32  
33 Confirmatory Factor Analysis. *Research on Aging*. 2001;23(5):503-531.  
34  
35 <https://10.1177/0164027501235001>  
36  
37
- 38 Phillips, L. R., & Guo, G. (2011). Mistreatment in Assisted Living Facilities: Complaints,  
39  
40 Substantiations, and Risk Factors. *The Gerontologist*, 51(3), 343–353.  
41  
42 <https://doi.org/10.1093/geront/gnq122>  
43  
44
- 45 Pfeffer, J., & Salancik, G. R. (2003). The external control of organizations: A resource  
46  
47 dependence perspective. Stanford, CA: Stanford University Press.  
48
- 49 Rabe-Hesketh, S., and A. Skrondal. 2012. Multilevel and Longitudinal Modeling Using  
50  
51 Stata. 3rd ed. College Station, TX: Stata Press.  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Smith, L., Carder, P., Bucy, T., Winfree, J., Brazier, J. F., Kaskie, B., & Thomas, K. S.  
4  
5 (2021). Connecting policy to licensed assisted living communities, introducing  
6  
7 health services regulatory analysis. *Health Services Research*, 1475-  
8  
9 6773.13616. <https://doi.org/10.1111/1475-6773.13616>  
10  
11

12 Zimmerman S, Sloane PD, Williams CS, et al. Dementia Care and Quality of Life in  
13  
14 Assisted Living and Nursing Homes. *The Gerontologist*. 2005;45(suppl\_1):133-  
15  
16 146. [https://doi.org/10.1093/geront/45.suppl\\_1.133](https://doi.org/10.1093/geront/45.suppl_1.133)  
17  
18

19 Zimmerman, S., Sloane, P. D., & Reed, D. (2014). Dementia Prevalence And Care In  
20  
21 Assisted Living. *Health Affairs*, 33(4), 658–666.  
22  
23 <https://doi.org/10.1377/hlthaff.2013.1255>  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Tables/Figures

Table 1. Descriptive statistics of deficiency citations by year, 2008-2016

Year	Number of visits	Did not receive any citations	Received at least one citation	Number of deficiency citations
	n (%)	n (%)	n (%)	Mean (SD)
2008	137 (100%)	9 (6.6%)	128 (93.4%)	7.2 (5.6)
2009	198 (100%)	43 (21.7%)	155 (78.3%)	6.2 (6.1)
2010	239 (100%)	68 (28.5%)	171 (71.6%)	3.8 (4.2)
2011	201 (100%)	36 (17.9%)	165 (82.1%)	5.7 (5.3)
2012	195 (100%)	43 (22.1%)	152 (78.0%)	4.8 (4.7)
2013	238 (100%)	75 (31.5 %)	163 (68.5%)	3.9 (4.3)
2014	192 (100%)	26 (13.5%)	166 (86.5%)	6.9 (5.0)
2015	209 (100%)	49 (23.4%)	160 (76.6%)	5.1 (4.8)
2016	217 (100%)	37 (17.1%)	180 (83.0%)	4.7 (4.2)
Total	1,826 (100%)	386 (21.1%)	1,440 (78.9%)	5.2 (5.0)

Note: Data are from 1,826 initial and re-licensure survey visits from 526 AL/RC licensed in Oregon between 2008 and 2016. Mean was calculated as the average number of deficiency citations per survey visit, including those that did not result in any citations. n = number; % = percentage; SD = standard deviation.

Table 2. AL/RC characteristics at survey year by whether survey resulted in deficiency citations

Variable	No citation (n=386; 21.1%)	One or more citations (n=1,440; 78.9%)	All visits (n=1,826; 100%)
<b>Organizational Characteristics</b>			
Survey year (M)	2012.2 (2.3)	2012.1 (2.6)	2012.2 (2.5)
Years open at the time of survey (M)	13.1 (7.0)	13.8 (8.1)	13.7 (7.9)
Size*			
6-24	37.6%	21.7%	25.0%
25-49	26.4%	27.0%	26.9%
50-74	20.0%	28.3%	26.6%
75-99	13.2%	16.3%	15.7%
100 and over	2.9%	6.7%	5.9%
License Type*			
AL	41.7%	46.2%	45.2%
RC	36.5%	25.4%	27.7%
MC	19.7%	21.9%	21.5%
Mixed	2.1%	6.5%	5.6%
Medicaid contract*	71.0%	79.8%	77.9%
Administrator tenure (in years) (M)*	2.9 (2.5)	2.4 (2.4)	2.5 (2.5)
Non-profit*	14.8%	9.5%	10.6%
Highest quartile of market share*	18.7%	26.7%	25.0%
<b>Environment Characteristics</b>			
CBSA Code			
Metropolitan	80.3%	76.8%	77.6%
Rural	2.9%	4.9%	4.5%
Micropolitan	16.8%	18.3%	18.0%
Number of SNF beds in county (M)	907.4 (869.4)	916.2 (907.2)	914.3 (899.1)
Highest quartile of percent of population who are:			
Older adults	27.2%	24.2%	24.9%
In poverty	26.2%	22.2%	23.0%
Unemployed*	28.5%	23.0%	24.2%
Dual Medicaid/Medicare eligible	22.8%	25.3%	24.8%
HHI			
Most competitive (0.03-0.05)	33.4%	33.7%	33.6%
Moderately concentrated (0.06-0.22)	37.6%	32.2%	33.4%
Highly concentrated (0.23-1.00)	29.0%	34.1%	33.0%

Note: Based on pooled data from initial and re-licensing survey visits of 526 AL/RC from 2008-2016. (M) next to variable name indicates means and standard deviations (parenthesis) are reported; all other statistics are column percentages. Asterisk (\*) attached to a variable name indicates that characteristics were statistically significantly

1  
2  
3 different at  $p < 0.05$  in bivariate analyses between facilities with no deficiency citations  
4 versus one or more deficiency citations based on  $t$ -tests (means) and Pearson's chi-  
5 squared (percentages). AL = assisted living; RC = residential care; MC = memory care.  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For Peer Review

Table 3. Results from multilevel mixed effects regression models of having at least one deficiency citation from a licensure visit and number of deficiencies

Variable	Any Citation (OR)		Number of Citations (IRR)	
	OR	95% CI	IRR	95% CI
<b>Organizational Characteristics</b>				
Survey year	0.93*	[0.88,0.98]	0.96***	[0.94,0.98]
Years open at the time of survey	1.01	[0.99,1.03]	1.01	[1.00,1.02]
Size (ref. 6-24)				
25-49	1.91**	[1.24,2.93]	1.40***	[1.15,1.70]
50-74	2.75***	[1.61,4.69]	1.60***	[1.27,2.02]
75-99	2.42**	[1.32,4.42]	1.66***	[1.28,2.16]
100 and over	4.92***	[2.17,11.16]	2.39***	[1.77,3.23]
License Type (ref. AL)				
RC	1.08	[0.70,1.69]	1.30**	[1.09,1.56]
MC	1.82**	[1.16,2.84]	1.34***	[1.13,1.58]
Mixed	3.12**	[1.45,6.72]	1.45***	[1.20,1.76]
Medicaid contract	1.31	[0.92,1.85]	1.12	[0.95,1.32]
Administrator tenure (in years)	0.92**	[0.87,0.98]	0.97*	[0.95,1.00]
Non-profit (ref. For-profit)	0.47**	[0.29,0.76]	0.59***	[0.46,0.77]
Highest quartile of market share	1.25	[0.71,2.19]	1.20	[0.95,1.52]
<b>Environment Characteristics</b>				
CBSA Code (ref. Metropolitan)				
Rural	3.08*	[1.16,8.19]	1.83***	[1.30,2.56]
Micropolitan	1.03	[0.58,1.81]	0.93	[0.72,1.20]
Number of SNF beds in county	1.00	[1.00,1.00]	1.00	[1.00,1.00]
Highest quartile of percent of population who are:				
Older adults	0.78	[0.52,1.17]	0.92	[0.77,1.10]
In poverty	0.76	[0.54,1.08]	0.92	[0.81,1.04]
Unemployed	0.64**	[0.46,0.89]	0.82**	[0.72,0.94]
Dual Medicaid/Medicare eligible	1.15	[0.71,1.86]	1.01	[0.84,1.22]
HHI (ref. Most competitive)				
Moderately Concentrated	0.97	[0.63,1.49]	1.17	[0.99,1.40]
Highly Concentrated	1.57	[0.78,3.13]	1.43*	[1.05,1.94]

Note: Based on mixed effects logistic regression (column 2; baseline = 79%) and mixed effects Poisson regression (column 3; mean=5.21) models using data from 1,826 licensure and re-licensure survey visits from 526 AL/RC licensed in Oregon between 2008 and 2016. Facility-level random intercepts are included but now shown; facility-level clustered standard errors. OR = Odds ratio; IRR = Incidence Rate Ratio; HHI = Herfindahl-Hirschman Index; SNF = Skilled Nursing Facility.

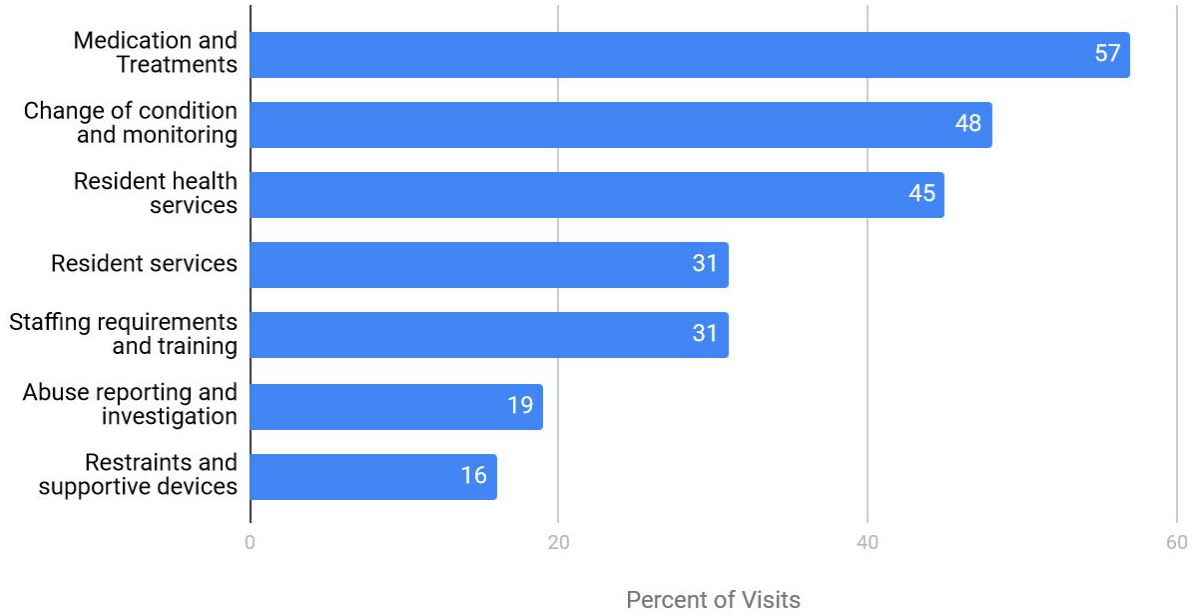
\*p < .05.

\*\*p < .01.

\*\*\*p < .001.

Figure 1. Prevalence of a Subset of Deficiency Citations for Licensing Visits

Description of Tags



Note: Percentages based on 1,826 initial and re-licensure survey visits from 527 AL/RC licensed in Oregon between 2008 and 2016. Survey visits that resulted in a specific tag more than once during a visit are included only once.

Review

## Supplemental Tables

Supplemental Table 1. Sensitivity Analysis Dropping 2008-2009 Data

	Logit OR/IRR	95% CI	Poisson OR/IRR	95% CI
Survey year	1.07	[0.97,1.17]	1.01	[0.99,1.04]
# years open at time of survey	1.00	[0.98,1.03]	1.00	[0.99,1.01]
Size (ref. 6-24)				
25-49	2.13**	[1.33,3.42]	1.76***	[1.42,2.17]
50-74	2.96***	[1.65,5.33]	1.89***	[1.49,2.39]
75-99	2.47**	[1.27,4.83]	1.96***	[1.50,2.57]
100 and over	7.15***	[2.80,18.24]	2.74***	[2.08,3.62]
License Type (ref. AL)				
RC	1.10	[0.67,1.80]	1.41***	[1.16,1.71]
MC	1.78*	[1.09,2.90]	1.38***	[1.16,1.65]
Mixed	2.86*	[1.28,6.37]	1.51***	[1.21,1.87]
Medicaid	1.30	[0.89,1.88]	1.13	[0.95,1.34]
Admin. Tenure	0.93*	[0.87,0.99]	0.97*	[0.95,1.00]
Nonprofit (ref. For-Profit)	0.45**	[0.26,0.76]	0.61***	[0.47,0.79]
Highest quartile of market share	1.35	[0.75,2.43]	1.20	[0.92,1.55]
CBSA Code (ref. Metropolitan)				
Rural	3.20*	[1.15,8.88]	2.01***	[1.42,2.84]
Micropolitan	1.05	[0.57,1.93]	0.96	[0.74,1.23]
Number of SNF beds in county	1.00	[1.00,1.00]	1.00	[1.00,1.00]
Highest quartile of percent of p	0.76	[0.50,1.16]	0.85	[0.70,1.02]
Highest quartile of percent of p	0.88	[0.60,1.29]	1.04	[0.88,1.22]
Highest quartile of percent unem	1.01	[0.65,1.58]	0.82*	[0.68,0.99]
Highest quartile of percent of p	1.35	[0.81,2.25]	1.06	[0.88,1.27]
HHI (ref. Most competitive)				
Moderate Concentrated	0.74	[0.45,1.23]	0.97	[0.78,1.19]
Highly Concentrated	1.15	[0.53,2.47]	1.22	[0.86,1.71]



Supplemental Table 2. Sensitivity Analysis Using Mixed-Effects Negative Binomial Model

	Nbreg OR/IRR	95% CI
Survey year	0.96***	[0.95,0.98]
# years open at time of survey	1.01	[1.00,1.01]
Size (ref. 6-24)		
25-49	1.47***	[1.24,1.75]
50-74	1.70***	[1.40,2.07]
75-99	1.69***	[1.35,2.12]
100 and over	2.31***	[1.80,2.97]
License Type (ref. AL)		
RC	1.37***	[1.16,1.61]
MC	1.27**	[1.09,1.47]
Mixed	1.44***	[1.21,1.71]
Medicaid	1.23**	[1.08,1.41]
Admin. Tenure	0.97**	[0.95,0.99]
Nonprofit (ref. For-Profit)	0.66***	[0.54,0.82]
Highest quartile of market share	1.08	[0.87,1.33]
CBSA Code (ref. Metropolitan)		
Rural	2.01***	[1.49,2.70]
Micropolitan	1.03	[0.84,1.26]
Number of SNF beds in county	1.00	[1.00,1.00]
Highest quartile of percent of p	0.87	[0.74,1.02]
Highest quartile of percent of p	0.89	[0.79,1.00]
Highest quartile of percent unem	0.82**	[0.72,0.93]
Highest quartile of percent of p	1.09	[0.94,1.27]
HHI (ref. Most competitive)		
Moderate Concentrated	1.25**	[1.07,1.45]
Highly Concentrated	1.31*	[1.01,1.69]
lnalpha	0.82**	[0.70,0.95]

Supplemental Table 3. Sensitivity Analysis Dropping Number of Certified SNF Beds in County as a Covariate

	Logit		Poisson	
	OR/IRR	95% CI	OR/IRR	95% CI
Survey year	0.93*	[0.88,0.98]	0.96***	[0.94,0.98]
# years open at time of survey	1.01	[0.99,1.03]	1.01	[1.00,1.02]
Size (ref. 6-24)				
25-49	1.92**	[1.25,2.93]	1.40***	[1.15,1.70]
50-74	2.77***	[1.63,4.70]	1.61***	[1.28,2.03]
75-99	2.44**	[1.34,4.45]	1.68***	[1.29,2.18]
100 and over	5.03***	[2.24,11.29]	2.45***	[1.82,3.29]
License Type (ref. AL)				
RC	1.09	[0.70,1.70]	1.32**	[1.11,1.58]
MC	1.83**	[1.17,2.85]	1.35***	[1.14,1.59]
Mixed	3.15**	[1.47,6.78]	1.46***	[1.20,1.77]
Medicaid	1.31	[0.93,1.85]	1.12	[0.95,1.32]
Admin. Tenure	0.92**	[0.87,0.98]	0.97*	[0.95,1.00]
Nonprofit (ref. For-Profit)	0.47**	[0.29,0.76]	0.60***	[0.46,0.77]
Highest quartile of market share	1.24	[0.71,2.19]	1.20	[0.95,1.51]
CBSA Code (ref. Metropolitan)				
Rural	3.01*	[1.14,7.99]	1.80***	[1.28,2.53]
Micropolitan	1.01	[0.57,1.77]	0.92	[0.71,1.19]
Highest quartile of percent of p	0.79	[0.53,1.18]	0.92	[0.77,1.10]
Highest quartile of percent of p	0.76	[0.54,1.08]	0.91	[0.80,1.03]
Highest quartile of percent unem	0.64**	[0.47,0.89]	0.83**	[0.72,0.94]
Highest quartile of percent of p	1.25	[0.86,1.81]	1.05	[0.89,1.23]
HHI (ref. Most competitive)				
Moderate Concentrated	0.92	[0.62,1.34]	1.15	[0.97,1.35]
Highly Concentrated	1.43	[0.77,2.67]	1.35*	[1.02,1.79]