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Associations Between Residence Type and Health Outcomes for Individuals with Developmental Disabilities Following the COVID-19 Pandemic:

A Quantitative Analysis

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Background

Over the last two decades, there has been a notable shift in residential service models for adults with intellectual and developmental disabilities (ID/DD), transitioning individuals away from institutional settings towards community-based arrangements such as dispersed housing and cluster housing.[1–6] It is widely acknowledged that the choice of residential setting has a profound impact on the well-being and outcomes of individuals with ID/DD, encompassing their quality of life, physical and mental health, social integration, and overall satisfaction.[7–11]

Extensive research has examined these effects, providing valuable insights into the advantages and disadvantages of various residential settings.[12–16] Studies have explored outcomes related to physical and mental health, social well-being, adaptive behavior, and overall quality of life.[17,18] Additionally, research has identified a variety of contributing factors – including individual, environmental, social, policy, cultural, and familial - that influence the associations between residential settings and these outcomes.[19]

Further, the COVID-19 pandemic has disproportionately affected individuals with developmental disabilities, particularly those in various residential settings. Research has shown that this population faced heightened risks of infection, severe illness, and mortality due to COVID-19.[20,21] The pandemic exposed and exacerbated existing healthcare disparities, with individuals in congregate care settings often experiencing higher infection rates and more severe outcomes.[20] Moreover, pandemic-related disruptions to support services, social isolation, and changes in daily routines significantly impacted the mental health and overall well-being of individuals with developmental disabilities across different residential settings.[22]

The literature has drawn upon theoretical frameworks such as social integration theory, ecological models of disability, and person-centered approaches to better understand these interactions and complexities.[23] Collectively, this body of knowledge underscores the importance of understanding the impact of different residential models when considering health outcomes and quality of life for people with disabilities, as we shift from institutional settings.[15,24] Collectively, with the shift from institutionalized settings, this body of knowledge highlights the importance of considering the implications of residence type on health outcomes and quality of life for people with disabilities.

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Gaps in the Literature

Despite the extensive research on this topic, several gaps and missing links remain:

Mental Health Outcomes: Although some studies have explored aspects of health outcomes, there is still a need for more research specifically focused on mental health, and how different residential settings contribute to these outcomes. A more detailed exploration of specific mental health conditions and interventions is warranted.

Health Outcomes Specific to Intellectual Disabilities: Existing research has mainly focused on well-being and quality of life, with limited emphasis on health outcomes, specific to those with disabilities. Exploring these health aspects in greater detail is crucial, prompting our research goal: assessing the association between residence type and health outcomes for people with developmental disabilities.

Significance of Research

Addressing these gaps is of paramount significance for several reasons:

Enhanced Decision-Making: Filling these gaps will provide a more comprehensive understanding of the effects of residential settings on individuals with ID/DD. This knowledge can inform better decision-making for individuals, families, service providers, and policymakers.

Improved Quality of Life: A deeper understanding of the relationship between residential settings and health outcomes can lead to the development of more effective support systems. This, in turn, can improve the quality of life and well-being of individuals with ID/DD.

Healthcare Planning: Focusing on specific health outcomes related to intellectual disabilities can aid in healthcare planning and the provision of targeted interventions for this population.

Rationale & Hypothesis

The study aims to investigate the associations between different types of residential settings and health outcomes for individuals with intellectual and developmental disabilities using National Core Indicators (NCI) data and STATA for analysis. The rationale for this research lies in the critical need to bridge existing gaps in the literature and to provide a comprehensive understanding of the impact of residential settings on the well-being of this population. This research will build upon previous work by focusing on specific health outcomes, encompassing both physical and mental health, which remains an underexplored area. This work also adds to the literature by conducting analysis on a larger dataset, encompassing more participants than other studies in this area.

We hypothesize that the choice of residential setting will be significantly associated with the physical and mental health conditions of individuals with ID/DD. Specifically, we anticipate that residential settings where individuals are more emersed in their community will be associated with better mental health outcomes when compared to more restrictive settings.

Methods

This research employs a quantitative approach to analyze the In-Person Survey (IPS) from the National Core Indicators – Intellectual and Developmental Disabilities (NCI-IDD).[25] The study

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will be cross-sectional in nature, focusing on a single point in time to assess the relationship between residence type and health outcomes.

Data Collection Methods

Data Source: The primary data source for this research is the 2021-2022 In-Person Survey (IPS) from the National Core Indicators (NCI) database. NCI is a well-established program, maintaining the NCI-IDD project, which collects information on the experiences of individuals with intellectual and developmental disabilities. NCI-IDD was initiated in 1996 by the National Association of State Directors of Developmental Disabilities Services (NASDDDS) and the Human Services Research Institute (HSRI). The IPS contains a survey that is conducted in a face-to-face setting. Individuals receive annual standardized training to maintain their status as NCI-IDD surveyors. To ensure statistical accuracy, states conduct at least 400 surveys. Data is cleaned and invalid responses are subsequently dropped. Finally, state data are merged into a national dataset.[26] The NCI dataset includes a wide range of variables related to residential settings, health outcomes, and quality of life. Data for the IPS was gathered through direct discussions with the service recipient. Further, background details were predominantly derived from the individual's records. To ensure that the survey was valid for people with IDD, the survey implemented a two-pronged approach. Responses to Section I inquiries, focusing on personal experiences and necessitating subjective answers, solely came from the service recipient. In contrast, Section II of the survey, encompassing objective queries about the individual's community engagement, choices, respect, rights, and service access, permitted the involvement of a "proxy" or another informant familiar with the individual, such as a family member or friend. All individuals were given the opportunity to participate in the face-to-face interview portion, and there was no cutoff of answers provided to consider a survey complete. Surveys were excluded from the analysis if 1) no questions were answered or 2) if the individual receiving support did not respond "validly" to the questions in section 1.[26] Access to this data was provided by The National Association of State Directors of Developmental Disabilities Services (NASDDDS) via the Human Services Research Institute (HSRI).

Sample Size: The study sample consisted of 13,559 individuals with intellectual and developmental disabilities, who received services from their state developmental disabilities service system. 453 of those individuals did not respond or responded "don't know" to their residence type and were subsequently excluded from the study, leaving a total sample size of 13,106. The demographic information and breakdown of participants is detailed in Table 1.

Measures

We utilized a range of variables to investigate the associations between various residential settings and health outcomes among individuals with intellectual and developmental disabilities including the demographic information of age, gender, and race. Age provided insights into the age distribution of the study population while the variable gender categorized participants as "Male," "Female," or "Other," allowing for gender-based analyses. To examine racial disparities in the outcomes, a series of categorical variables indicating race were employed, including "American Indian," "Asian," "Black," Hawaiian," "White," "Latino," and "other," with each coded as "Yes" or "No" to indicate racial background. Based on records, race was selected, with an opportunity to select "other."

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Our independent variable, residence type, was crucial for characterizing the participants' residential settings. The data encompassed a wide array of settings including institutional, provider manager, family living, and independent living options (Table 1). Based on records, a residence type was assigned to the individual. These setting types are included in the NCI data.[26,27]

Table 1. Setting Types

Intermediate Care Facility for Individuals with Intellectual Disabilities (ICF/IID), 4-6 residents with disabilities	ICF/IID facilities that have 4-6 residents with an intellectual disability.
ICF/IID, 7-15 residents with disabilities	ICF/IID facilities that have 7-15 residents with an intellectual disability.
ICF/IID, 16 or more residents with disabilities	ICF/IID facilities that have 16 or more residents with an intellectual disability.
Nursing Facility	A nursing facility is a facility in which patients receive nursing care and related services.
Other Specialized Institutional Facility	Participants live in a specialized institutional facility that is not an ICF/IID or a nursing facility.
Group Living Setting, 2-3 People With Disabilities	A group home setting where 2-3 people have a disability.
Group Living Setting, 4-6 People With Disabilities	A group home setting where 4-6 people have a disability.
Group Living Setting, 7-15 People With Disabilities	A group home setting where 7-15 people have a disability.
Lives in Own Home or Apartment	A participant’s own home which may be owned or rented, or may be shared with roommate(s) or spouse.
Parent/Relative’s Home	A participant’s parent or relative’s home which may include paid services to the family for residential support.
Foster Care (2+)	Round-the-clock services provided in a single-family residence where two or more people with a disability live with a person or family who furnishes services.
Foster care (1)	Round-the-clock services provided in a single-family residence where only one person with a disability lives with a person or family who furnishes services (sometimes called shared living).
Homeless or crisis bed placement:	Participant does not have a ‘’permanent” home and is in a crisis bed placement or is experiencing homelessness.

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*ICF/IID facilities are Medicare or Medicaid Intermediate Care Facilities for Individuals with Intellectual Disabilities with 4 or more beds that provide “active treatment” (CMS). All 50 states have at least one ICF/IDD.

The outcome variables in our analysis comprised a set of binary variables: “mood disorder," "anxiety disorder," "behavior disorder," "psychotic disorder," "other mental illness/psychiatric diagnosis," "cardiovascular disease," "diabetes," "cancer," "high blood pressure," and "high cholesterol." Utilizing medical records, “yes” or “no” was selected reflecting if a participant had the health condition of the question. These variables indicate the presence or absence of specific health conditions, which are instrumental in understanding the relationship between residential settings and health outcomes among individuals with ID/IID.

To account for potential confounding factors, in addition to controlling for demographic factors, we also incorporated the categorical variable mobility, which characterizes participants as either "moves self around the environment without aids," "moves self around the environment with aids, or uses a wheelchair independently," or "non-ambulatory; always needs assistance to move around the environment." This covariate is vital for controlling for factors related to mobility in our analysis, therefore avoiding a self-selecting effect in the correlation between residential settings and health outcomes due to mobility restrictions. Overall, these variables collectively form a robust framework for an examination of the complex associations between residential settings and various health outcomes while considering crucial demographic and covariate information to enhance the rigor of our analysis (Table 2).

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Table 2. Descriptive Statistics.

	ICF/IID, 4-6	ICF/IID, 7-15	ICF/IID, 16+	Nursing facility	Other specialized institutional facility	Group living setting, 2-3 people with disabilities	Group living setting, 4-6 people with disabilities	Group living setting, 7-15 people with disabilities	Own home or apartment	Parent/relative's home	Foster care (2+)	Foster Care (1)	Homeless or crisis bed placement
n	151	310	98	29	12	1600	2469	592	1963	5015	438	419	10
Marital Status													
Single, never married	146	300	83	24	11	1488	2333	555	1689	4838	416	397	7
Married	1	0	1	1	0	11	12	4	103	19	4	5	1
Single, married in the past	1	3	2	3	0	42	35	12	120	58	11	11	1
Don't know	0	1	0	1	0	20	44	18	27	42	5	3	1
No Response	3	6	12	0	1	39	45	3	24	58	2	3	0
Parental Status													
Yes	3	5	0	3	1	51	36	6	134	109	16	15	3
No	27	297	82	15	11	1388	1864	307	1542	4099	374	382	5
No Response	23	8	16	11	0	161	569	279	287	27	48	22	2
Gender													
Male	80	203	52	16	6	953	1457	383	1124	3033	251	235	4
Female	71	107	45	13	6	641	1006	209	835	1968	185	182	6
Other	0	0	1	0	0	1	0	0	2	2	1	0	0
Don't know	0	0	0	0	0	0	0	0	0	0	0	0	0
No Response	0	0	0	0	0	5	6	0	2	12	1	2	0
Diagnosed ID													
No	7	16	5	1	1	80	102	20	262	796	20	18	1

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Yes	143	293	91	11	11	1489	2330	565	1664	4127	414	395	9
Don't know	0	1	1	0	0	14	15	4	25	47	3	3	0
No Response	1	0	1	0	0	17	22	3	12	45	1	3	0
Race													
American Indian	1	0	1	0	0	19	21	3	30	42	7	8	1
Asian	1	3	1	0	0	13	26	3	20	136	7	4	0
Black	20	28	9	3	2	226	446	92	323	853	77	98	2
Hawaiian	0	1	1	0	0	4	3	0	3	16	0	0	0
White	122	269	85	25	9	1248	1817	437	1498	3334	321	281	8
Latino	6	4	2	0	1	47	85	27	61	373	22	15	1
Other	0	4	0	0	0	12	25	5	29	122	10	8	0
Don’t know	3	2	0	1	0	18	31	22	22	179	5	6	0
No Response													
Mobility													
Moves self around environment without aids	99	220	35	9	9	1188	1710	405	1560	3852	320	317	6
Moves self around environment with aids or uses wheelchair independently	25	61	17	11	3	269	487	120	289	663	82	62	2
Non-ambulatory; always needs assistance to move around environment	23	23	31	*9*	0	107	215	59	92	440	34	27	1
Don't know	1	0	2	0	0	22	32	4	9	28	1	11	0
No Response	3	6	13	0	0	14	25	4	13	32	1	2	1
Remote Support													
No, none	114	294	77	15	10	1387	1855	405	1530	3964	351	338	9
Yes, 24-hour remote supports	7	9	6	1	1	42	106	46	61	75	16	10	0
Yes, less than 24-hour remote supports	1	1	3	0	1	33	32	8	65	145	5	15	1
Don't know	10	0	0	1	0	105	229	113	115	442	44	53	0
No Response	19	6	12	12	0	33	247	20	192	389	22	3	0

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Data Extraction

Relevant data from the NCI dataset were extracted, focusing on variables related to residential settings (e.g., type of setting), health outcomes (e.g., physical health, mental health), and demographic and other covariates (e.g., race, age, gender, mobility).

Ethical Considerations

This research adhered to ethical guidelines related to the use of the NCI dataset. The study was also deemed "not human subjects research" and "secondary data analysis involving the use of existing de-identified data/specimens, including publicly available data" by the Institutional Review Board (IRB) of Johns Hopkins Bloomberg School of Public Health. Data was stored and analyzed in a confidential manner.

Analysis Methods

Statistical Software: Statistical analysis was conducted using STATA BE 17.0, a statistical software widely employed in social science research.[28] STATA provides a range of tools for data management, regression analysis, and hypothesis testing, making it suitable for our study's quantitative analysis.

Analytical Approach

Our outcome variables were binary categorical variables, and our independent variable was a categorical variable with multiple categories. The categorical variable of residence type was then split into 13 separate dummy variables, allowing analysis of each of the residence types. Based on the variable type and our research question, logistic regression analysis was employed to examine the associations between different residential settings and specific outcomes, such as physical health and mental health. Since the variable of residence type was separated into 13 dummy variables, the reference for each variable was the response "0," or not living in the residence type. Therefore, for each outcome, the odds ratio of each residence type represents the odds of having the health condition if one lives in the residence type as compared to if they did not. This approach allowed us to identify statistically significant relationships and quantify the magnitude of these associations. In the analysis, statistical significance was determined using a significance level of $p < 0.05$.

In our logistic regression analysis, we selected covariates to control for a priori. We controlled for the variables gender, age, race, and mobility to account for potential confounding factors.

Rationale for Choosing the Methodological Strategy

The choice of a quantitative methodological approach, along with the utilization of NCI data and STATA, is well-suited for this research for several reasons. First, NCI data is a national dataset that provides a comprehensive view of the experiences of individuals with ID/DD across various residential settings and across nearly every state in the United States. This allows for a robust analysis that can inform broader policy discussions.

Second, the quantitative approach provides the means to systematically assess the relationships between residence type and health outcomes. By controlling for potential confounding variables,

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we can isolate the impact of residential settings on mental health outcomes, thus enhancing the rigor of our findings.

In summary, the methodological strategy chosen for this study aligns with the research objectives and the need to address the identified gaps in the literature. It allows for a comprehensive analysis of the associations between residential settings and health outcomes for individuals with ID/DD, ultimately contributing to improved decision-making, resource allocation, and healthcare planning in this critical area.

Results

The logistic regression analyses were conducted to examine the associations between different residence types and various mental health and physical health outcomes while controlling for potential confounding variables. The models included residence type as the primary independent variable, separated into 13 dummy variables, and adjusted for demographic factors such as age and gender, mobility, and racial/ethnic backgrounds. The associated health factors considered were anxiety, mood, behavior, psychotic symptoms, other mental health problems, cardiovascular conditions, diabetes, cancer, high blood pressure (HBP), and high cholesterol. Results from the multivariable logistic regression analysis can be seen in Table 3. Odds ratios for each category are compared to the reference group “0” or does not live in the residence type. Statistically significant associations are bolded. Graphical representations of the significant results (< 0.05) can be seen in Figure 1.

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Table 3. Multivariable Regression Analysis of Predictors of Health Outcomes for People With Developmental Disabilities

	Anxiety Disorder	Mood Disorder	Behavior Disorder	Psychotic Disorder	Other Mental Disorder	Cardiovascular Disease	Diabetes	Cancer	High Blood Pressure	High Cholesterol
ICF/IID 4TO6	0.64 (0.39,1.06)	0.62 (0.38,1.01)	**1.88 (1.11,3.18)**	**2.24 (1.05,4.77)**	**0.24 (0.11,0.53)**	0.48 (0.19,1.22)	0.63 (0.31,1.31)	3.95 (0.76,20.53)	**0.45 (0.24,0.88)**	0.58 (0.29,1.18)
ICF/IID 7TO15	0.68 (0.45,1.02)	1.16 (0.78,1.71)	1.22 (0.91,2.28)	**2.12 (1.08,4.17)**	**0.43 (0.25,0.74)**	**0.47 (0.23,0.96)**	0.70 (0.40,1.21)	1.15 (0.22,6.10)	0.63 (0.38,1.04)	0.77 (0.45,1.30)
ICF/IID 16PLUS	**0.43 (0.22,0.82)**	0.56 (0.31,1.03)	**4.17 (2.32,7.48)**	1.19 (0.42,3.34)	**0.39 (0.17,0.94)**	0.49 (0.14,1.15)	0.55 (0.24,1.26)	2.85 (0.50,16.34)	**0.39 (0.19,0.81)**	1.01 (0.50,1.30)
Nursing Facility	1.02 (0.41,2.53)	0.59 (0.22,1.57)	1.85 (0.68,5.04)	**3.70 (1.14,12.01)**	0.41 (0.09,1.85)	**3.02 (1.06,8.63)**	2.70 (0.98,7.43)	4.13 (0.53,31.99)	1.23 (0.45,3.38)	0.95 (0.32,2.82)
Other Institut. Facility	1.35 (0.39,4.67)	1.23 (0.36,4.25)	3.15 (0.89,11.16)	2.43 (0.47, 12.74)	1.36 (0.34,0.80)	0.63 (0.07,5.46)	0.80 (0.15,4.14)	1 (omitted)	0.71 (0.16,3.23)	0.59 (0.11,3.21)
Group Living (2-3)	0.80 (0.57,1.12)	**1.41 (1.01.1.96)**	**1.68 (1.14,2.49)**	**2.64 (1.44,4.86)**	**0.53 (0.35,0.80)**	**0.38 (0.21,0.68)**	0.77 (0.48,1.22)	1.49 (0.34,6.47)	0.85 (0.55,1.30)	1.03 (0.65,1.62)
Group Living (4-6)	0.72 (0.51,1.00)	1.18 (0.85,1.64)	**1.66 (1.13,2.45)**	2.03 (1.12,3.72)	**0.48 (0.32,0.71)**	0.63 (0.36,1.08)	0.73 (0.46,1.22)	2.66 (0.63,11.15)	0.80 (0.53,1.22)	1.06 (0.68, 1.65)
Group Living (7-15)	0.72 (0.50,1.01)	0.93 (0.64, 1.34)	**1.86 (1.22,2.84)**	**2.25 (1.19,4.27)**	0.80 (0.51,1.25)	0.83 (0.46,1.28)	**0.43 (0.25,0.72)**	**4.58 (1.07,19.72)**	**0.59 (0.37,0.94)**	0.86 (0.52,140)
Own Home	0.73 (0.52,1.02)	0.98 (0.70,1.37)	0.68 (0.46,1.01)	1.38 (0.75,2.54)	**0.71 (0.25,0.56)**	0.74 (0.42,1.28)	1.00 (0.63,1.57)	2.46 (0.58,10.43)	1.14 (0.75, 1.74)	1.18 (0.75,1.84)
Parent's Home	**0.40 (0.29,0.56)**	**0.32 (0.23,0.44)**	**0.53 (0.36,0.78)**	**0.52 (0.38,0.97)**	**0.16 (0.11,0.24)**	0.62 (0.36,1.09)	**0.56 (0.35,0.88)**	2.10 (0.49,9.02)	**0.62 (0.41,0.95)**	0.65 (0.41,1.01)
Foster Care (2+)	0.85 (0.58,1.26)	0.92 (0.63,1.35)	1.06 (0.68,1.66)	**2.64 (1.38,5.04)**	**0.45 (0.27,0.74)**	0.58 (0.30,1.12)	0.70 (0.41,1.19)	3.62 (0.81,16.28)	0.78 (0.48,1.26)	0.87 (0.53,1.45)

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Foster Care (1)	**0.64 (0.43,0.94)**	0.82 (0.56,1.21)	0.86 (0.55,1.35)	1.76 (0.90,3.44)	**0.34 (0.21,0.57)**	0.59 (0.30,1.17)	0.75 (0.44,1.28)	1.78 (0.35,9.12)	0.65 (0.40,1.07)	0.87 (0.53,1.45)
Homeless	0.59 (0.11,3.22)	0.21 (0.02,1.81)	1 (omitted)	1 (omitted)	2.21 (0.46,10.55)	1 (omitted)	0.83 (0.90,7.72)	1 (omitted)	0.64 (0.07,5.82)	1 (ommited)
American Indian	1.39 (0.82,2.36)	**2.18 (1.33,3.59)**	**1.95 (1.14,3.31)**	0.83 (0.37,1.87)	1.40 (0.64,3.03)	1.21 (0.47,3.14)	1.43 (0.72,2.84)	1 (omitted)	1.18 (0.62,2.25)	1.47 (0.75,2.90)
Asian	1.15 (0.69,1.90)	0.77 (0.45,1.32)	1.25 (0.75.2.08)	0.80 (0.35,1.81)	0.81 (0.34,1.94)	0.52 (0.15,1.77)	1.10 (0.53,2.28)	4.44 (0.929,21.26)	0.88 (0.44,1.75)	1.89 (0.96,3.45)
Black	1.00 (0.70,1.45)	1.39 (0.97,1.98)	0.98 (0.67.1.45)	1.44 (0.79,2.62)	**1.85 (1.13,3.02)**	0.84 (0.39,1.80)	1.38 (0.80,2.36)	1.12 (0.26,4.72)	**1.97 (1.21,3.22)**	1.58 (0.96,2.61)
Hawaiian	0.99 (0.32,3.01)	1.15 (0.39,3.39)	0.54 (0.15,1.19)	0.58 (0.07,4.62)	**4.18 (1.31,3.02)**	1 (omitted)	0.51 (0.06,4.28)	1 (omitted)	2.31 (0.60,8.93)	1.25 (0.25,6.33)
White	**2.10 (1.47,3.01)**	**1.85 (1.30,2.63)**	1.32 (0.90,1.93)	0.71 (0.39,1.28)	**1.63 (1.00,2.64)**	0.95 (0.45,2.03)	0.78 (0.46,1.34)	1.35 (0.32,5.64)	0.88 (0.54,1.44)	**1.69 (1.03,2.78)**
Latino	1.36 (0.94,1.95)	**1.59 (1.11,2.27)**	1.25 (0.85,1.85)	0.98 (0.53,1.82)	**1.85 (1.13,3.04)**	1.41 (0.66,2.99)	1.03 (0.59,1.80)	0.93 (0.21,4.16)	0.96 (0.58,1.60)	1.57 (0.95,2.78)
Other Race	1.63 (1.02,2.61)	1.40 (0.87,2.23)	1.50 (0.92,2.46)	1.12 (0.53,1.82)	1.90 (1.00,3.63)	0.59 (0.20,1.95)	1.59 (0.82,3.07)	0.57 (0.06,5.45)	0.74 (0.38,1.43)	**1.92 (1.00,3.67)**
Age	**0.99 (0.99,1.00)**	1.00 (0.99,1.00)	**0.98 (0.98,0.98)**	**1.02 (1.01,1.02)**	**0.99 (0.99,0.99)**	**1.03 (1.02,1.03)**	**1.03 (1.02,1.03)**	**1.05 (1.04,1.06)**	**1.05 (1.04,1.05)**	**1.04 (1.04,1.05)**
Gender	**1.23 (1.13,1.34)**	**1.32 (1.22,1.44)**	**0.87 (0.80,0.96)**	1.02 (0.90,1.16)	1.11 (0.97,1.26)	0.95 (0.91,1.11)	1.06 (0.94,1.19)	0.85 (0.66,1.11)	**0.80 (0.72,0.89)**	0.90 (0.81,1.00)
Mobility	**0.70 (0.65,0.75)**	**0.74 (0.69,0.80)**	**0.79 (0.73,0.86)**	**0.55 (0.49,0.63)**	**0.85 (0.76,0.95)**	1.00 (0.88,1.13)	**0.69 (0.62,0.76)**	1.13 (0.94,1.36)	**0.78 (0.72,0.85)**	**0.65 (0.59,0.72)**

ICF/IID 4-6: Residents in ICF/IID settings accommodating 4-6 people with disabilities exhibited notable outcomes. They had significantly higher odds of experiencing behavior disorders (OR=1.88) and psychotic disorders (OR=2.24). However, these residents demonstrated significantly lower odds of other mental disorders (OR=0.24) and high blood pressure (OR=0.45).

ICF/IID 7-15: ICF/IID settings with 7 to 15 residents with disabilities displayed distinct patterns. These settings were significantly more likely to have residents with psychotic disorders (OR=2.12), but significantly less likely to have individuals with other mental disorders (OR=0.43) or cardiovascular disease (OR=0.47).

ICF/IID 16+: Individuals residing in ICF/IID settings accommodating 16 or more residents with disabilities had specific health outcomes. They exhibited decreased odds of anxiety (OR=0.43), other mental disorders (OR=0.39), and high blood pressure (OR=0.39). However, they displayed significantly increased odds of behavior disorders (OR=4.17).

Nursing Facility: Residents in nursing facilities maintained significantly higher odds of experiencing both psychotic disorders (OR=3.70) and cardiovascular disease (OR=3.02).

Other Institutionalized Facility: No significant findings were observed regarding health outcomes for individuals residing in other institutionalized facilities.

Group Living (2-3): Individuals in group living situations with 2 to 3 people with disabilities experienced distinct odds. They had significantly increased odds for mood disorders (OR=1.41), behavior disorders (OR=1.68), and psychotic disorders (OR=2.64). However, they had a decreased risk of other mental disorders (OR=0.53) and cardiovascular disease (OR=0.38).

Group Living (4-6): Residents in group living arrangements with 4-6 people with disabilities had significantly higher odds of behavior disorders (OR=1.66) and significantly lower odds of other mental disorders (OR=0.48).

Group Living (7-15): Individuals in group living settings with 7 to 15 people with disabilities had distinctive health outcomes. They demonstrated significantly increased odds of having behavior disorders (OR=1.86), psychotic disorders (OR=2.25), and cancer (OR=4.58). Conversely, group living settings of 7 to 15 residents maintained lower odds of individuals with diabetes (OR=0.43) and high blood pressure (OR=0.59).

Own Home: Participants living in their own homes maintained significantly lower odds of experiencing other mental disorders (OR=0.71).

Parent's Home: Individuals residing in a parent or relative's home were associated with protective factors. They had significantly lower odds for anxiety (OR=0.40), mood disorders (OR=0.32), behavior disorders (OR=0.53), psychotic disorders (OR=0.52), other mental disorders (OR=0.16), diabetes (OR=0.56), and high blood pressure (OR=0.62).

Foster Care (2+): Individuals living in a foster care setting with 2 or more people with disabilities had distinctive odds. They had significantly higher odds of experiencing psychotic disorders (OR=2.64) and significantly lower odds for other mental disorders (OR=0.45).

Foster Care (1): Individuals residing in a foster care setting with 1 person with a disability demonstrated unique odds. They had significantly lower odds for anxiety (OR=0.64) and other mental disorders (OR=0.34).

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Homeless: Individuals experiencing homelessness or in a crisis bed placement did not exhibit any significant odds for the examined health outcomes.

Covariates: While noting that the covariates were directly included in our overall analysis, so findings are in the context of all variables included in the analysis, several covariates emerged as important factors affecting health outcomes. Specifically, individuals identifying as American Indian were at a greater risk for mood and behavior disorders. Black individuals had increased odds of other mental disorders and high blood pressure, while White individuals had increased odds of anxiety disorders, mood disorders, and cardiovascular disease. Hawaiian individuals exhibited increased odds of other mental disorders, and Latino individuals had increased odds of mood disorders and other mental disorders. In no case did race serve as a protective factor.

Furthermore, age played a significant role in health outcomes, acting as a protective factor for anxiety, behavior disorders, and other mental disorders, but as a risk factor for psychotic disorders, cardiovascular disease, diabetes, cancer, high blood pressure, and high cholesterol. Gender also influenced outcomes, with females at a higher risk for anxiety and mood disorders, but at a lower risk for behavior disorders and high blood pressure. Increased mobility was found to be a protective factor for all examined mental health conditions, as well as for diabetes, high blood pressure, and high cholesterol.

Figure 1. Odds Ratio Forest Plots

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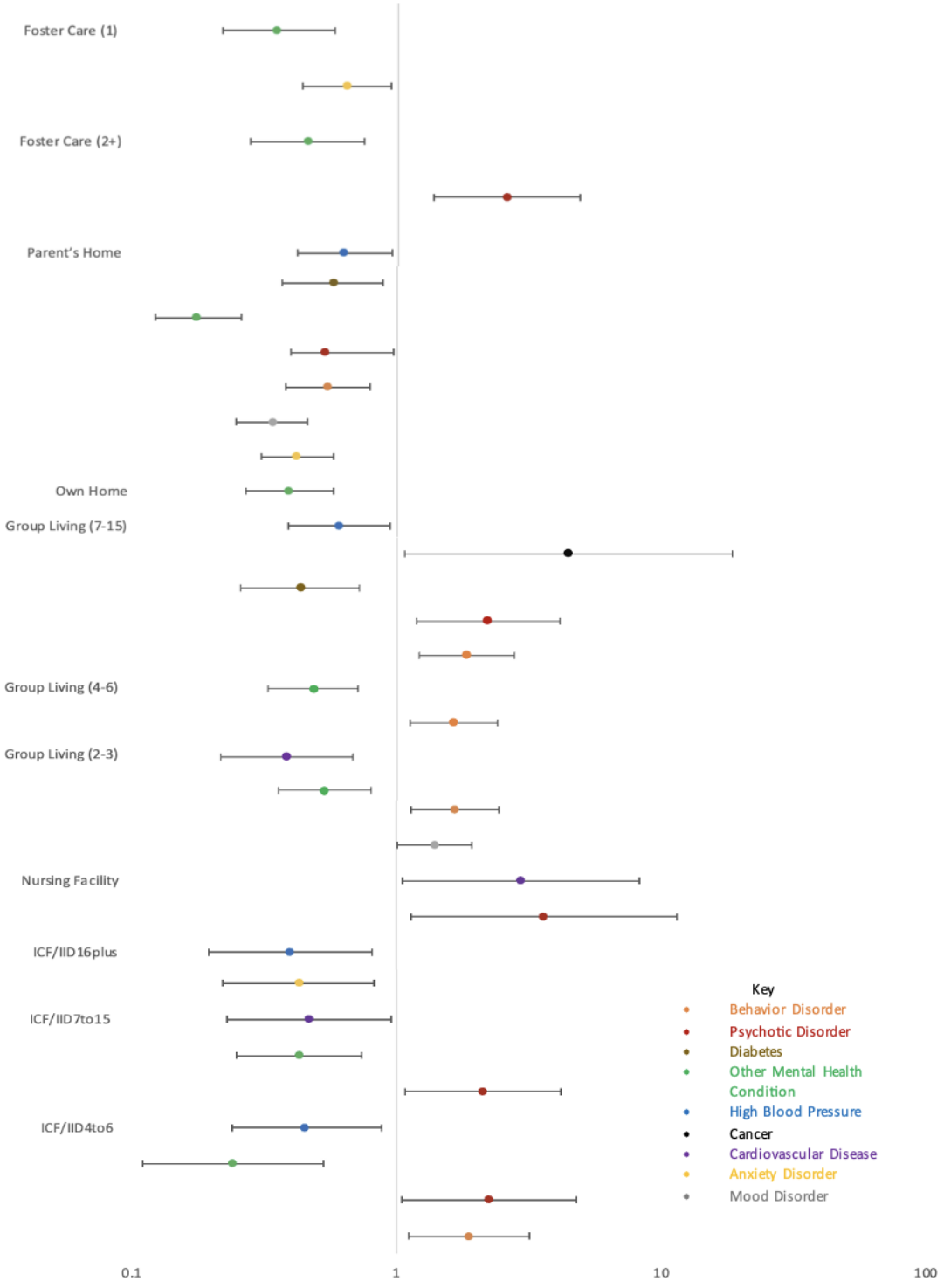

Discussion

Interpreting the Findings

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As outlined in the background, the literature emphasizes the multifaceted nature of these impacts, considering various factors such as physical and mental health, social integration, and environmental influences. Our study addresses existing gaps by delving into mental health outcomes and exploring specific health outcomes related to intellectual and developmental disabilities.

The logistic regression analyses unearthed nuanced associations between residence types and health outcomes, shedding light on the complexities of this relationship. Considering the significance threshold of $p<0.05$, our discussion focuses on statistically significant findings.

Institutionalized Settings

The analysis utilized 13 dummy variables that each represented a residence type. For purposes of the logistic regression analysis, odds ratios were calculated using the value "0" or those who do not live in the residence type as a reference group. Residents in institutional settings accommodating 4-6 individuals with disabilities exhibited heightened odds of behavior and psychotic disorders. However, they demonstrated lower odds of other mental disorders and high blood pressure. Larger ICF/IID settings (7-15 residents with disabilities) displayed elevated odds of psychotic disorders but lower odds of other mental disorders and cardiovascular disease. Residents in nursing facilities had higher odds of psychotic disorders and cardiovascular disease. Based on the analysis, individuals living in these settings, which are classified as "institutions" by the Centers for Medicare and Medicaid Services (CMS), are more likely to experience different mental health disorders. Depending on the specific setting, some of these settings are both risk and protective factors for different physical health conditions. This underscores the need for targeted interventions to address mental and physical health in these settings. However, contrasting findings for these institutionalized settings, residents in larger ICF/IID settings (16 or more residents with disabilities) showed decreased odds of anxiety, other mental disorders, and high blood pressure but increased odds of behavior disorders. This challenges the notion that larger settings universally lead to adverse outcomes and warrants further exploration.

Group Homes

Individuals in group living with 2-3 residents with disabilities faced increased odds of mood, behavior, and psychotic disorders. However, they had lower odds of other mental disorders and cardiovascular disease. Residents in group living with 4-6 individuals with disabilities had higher odds of behavior disorders but lower odds of other mental disorders. Unique health outcomes emerged for participants residing in group homes with 7-15 people with disabilities, with increased odds of behavior, psychotic disorders, and cancer, but decreased odds of diabetes and high blood pressure. All group home settings had increased odds for at least one mental health condition, but all group home settings were also protective for at least one health condition. These dichotomous results prompt further research with specific focus on health outcomes for individuals with developmental disabilities living in different group home settings.

Independent Living

Those living in their own homes exhibited lower odds of other mental disorders. Living in one's own home was only a protective factor and was not a risk factor for any physical or mental health conditions. This aligns with the understanding that personal autonomy and familiarity with living arrangements contribute to positive mental and physical health.

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Parent / Relative's Home

Residing in a parent or relative's home was associated with protective factors across various mental and physical health outcomes. This residence type was also only a protective factor and had no risk associated with it related to the mental and psychical health outcome examined. This highlights the role of familial support in fostering well-being.

Foster Care

Individuals in foster care with 2 or more residents with disabilities faced higher odds of psychotic disorders but lower odds of other mental disorders. On the other hand, foster care with 1 resident exhibited protective odds for anxiety and other mental disorders. These findings demonstrate the potential benefits of a more individual level of care, as, as those living as the only individual with a disability in a foster home experienced no risk factors for health conditions, and were at lower odds for two mental health conditions, as compared to those living in a foster home with two or more residents with a disability who were at increased odds for having psychotic disorders.

Homeless: Individuals experiencing homelessness did not exhibit significant odds for examined health outcomes. The transient nature of this setting may pose challenges for comprehensive health assessments.

Covariates Impact

Race emerged as a significant factor, with disparities observed in mental and physical health outcomes. Age played a protective role in certain mental health conditions but acted as a risk factor for others and physical health outcomes. Gender differences indicated varied susceptibility to mental health conditions, emphasizing the need for tailored interventions. Increased mobility consistently emerged as a protective factor, influencing both mental and physical health outcomes.

Limitations

This study, while providing valuable insights into the associations between residence types and health outcomes for individuals with intellectual and developmental disabilities, is subject to several limitations that warrant consideration. Firstly, the cross-sectional design employed in this research restricts our ability to establish causation, emphasizing the need for future longitudinal investigations. Further, the reliance on self-reported or caregiver-reported health outcomes introduces a potential source of bias or misreporting, particularly concerning the subjective nature of mental health conditions. The study's primary focus on quantitative measures may overlook the rich qualitative aspects of individuals' experiences in different residential settings. The categorization of residence types, while providing a broad overview, may oversimplify the diversity within each category, overlooking variations in the quality of care, support, and living conditions. Further, some residence types contained low levels of participants, resulting in difficulty in the interpretation of these results as well as generalizability. Additionally, the study did not delve into specific interventions or support services within each residence type, limiting the understanding of the mechanisms through which these settings influence health outcomes. Finally, the study did not explore potential interactions between residence types and individual characteristics, such as the severity of disability or pre-existing health conditions, which could influence outcomes. Recognizing these additional limitations is crucial for refining future

research endeavors and ensuring a more comprehensive understanding of the complexities involved in the relationship between residence types and health outcomes for individuals with intellectual and developmental disabilities.

Overall Findings

Ultimately, individuals living independently, with a parent or relative, and living in a foster care setting as the only individual with a disability were only exposed to decreased odds of having the mental and physical health outcomes examined and experienced no increased odds for any outcome. This highlights the benefits of a smaller, more personalized residence setting. These settings that experienced positive outcomes tend to provide individualized care and potentially a sense of familiarity and comfort for individuals. Results regarding group homes and institutionalized settings were varied, demonstrating the need for further, more focused research on these settings.

Policy Implications

Our findings contribute significantly to the ongoing efforts to rebuild and strengthen public health infrastructure for individuals with developmental disabilities. By elucidating the associations between residential settings and health outcomes, this research provides valuable insights for public health officials and policymakers. These findings can inform the development of more inclusive and responsive public health strategies that account for the diverse needs of individuals across various residential settings. For instance, understanding which residential models are associated with better health outcomes can guide the allocation of resources, the design of health promotion programs, and the implementation of preventive measures tailored to specific living arrangements. This knowledge is crucial for creating a more equitable and resilient public health system that can effectively support individuals with developmental disabilities, regardless of their residential setting, both during normal times and in the face of public health crises. The following are our policy and research recommendations:

1. Tailored Interventions for Different Settings: Policies should acknowledge the diversity of residential settings for individuals with intellectual and developmental disabilities (ID). Tailored interventions should be designed to address the specific mental and physical health needs of residents in various settings, such as ICF/IIDs, nursing facilities, group living, independent living, and foster care.
2. Staff Training and Support: Given the varied mental health profiles observed across different settings, there is a need for comprehensive training and support programs for staff working in these facilities. This includes training on recognizing and managing behavior and psychotic disorders, as well as strategies to promote positive mental health outcomes.
3. Holistic Health Assessments: Policy efforts should promote holistic health assessments that consider both mental and physical health outcomes.
4. Support for Independent Living: Policies that support individuals in living in their own homes or with family should be reinforced. Recognizing the protective factors associated with familial support, these policies should aim to empower families and individuals to maintain independence while providing necessary resources and assistance.

Future Research Directions

1. Longitudinal Studies: Conducting longitudinal studies can provide a deeper understanding of how residence types impact health outcomes over time. This would allow researchers to explore the dynamic nature of these relationships and identify potential causative factors.
2. Qualitative Research: Complementing quantitative findings with qualitative research can offer insights into the lived experiences of individuals with IDD in different settings. Understanding the social and environmental factors that contribute to mental and physical health outcomes can inform more targeted interventions.
3. Cost-Benefit Analysis: Conducting cost-benefit analyses of interventions in different residential settings can assist policymakers in allocating resources effectively. Understanding the economic impact of various interventions will contribute to the development of sustainable and efficient policies.

The findings from this study have significant implications for enhancing healthcare resilience for individuals with developmental disabilities in preparation for future public health crises. By identifying the residential settings associated with better health outcomes, we can develop more robust and adaptable care models. These insights can inform the creation of emergency preparedness plans tailored to different residential settings, ensuring that individuals with developmental disabilities receive appropriate care and support during crises. Moreover, understanding the relationship between residence type and health outcomes can guide the allocation of resources and the development of targeted interventions to strengthen the resilience of vulnerable populations across various living arrangements. By addressing these policy and research considerations, policymakers and researchers can work collaboratively to create evidence-based interventions that improve the overall health and well-being of individuals with intellectual and developmental disabilities across diverse residential settings.

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