**Project Proposal**

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EDPSY960 Structural Equation Modeling

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**The Relationship between Economic Environment, Nursing Homes Boundaries, Nursing Homes Throughputs, on Nursing Homes Outputs**

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has marked the most traumatic public health crisis of the new millennium (White et al., 2020). As a consequence of this pandemic, nursing homes (NHs) exposed critical vulnerabilities. Nursing home deficiencies citations (NHDCs), (henceforth deficiencies, NHDCs or deficiency citations), refer to citations issued by state-contracted inspection agencies for failures in meeting pre-specified standards of care and guidelines proposed and maintained by the Centers for Medicare and Medicaid (CMS). NHDCs range from inadequate staffing and poor infection prevention and control measures to insufficient medical care or abuse and neglect. These deficiencies have long been a concern in the healthcare sector, posing risks to resident safety and well-being. Amid the COVID-19 pandemic, the consequences of these deficiencies have been further magnified. Evidence suggests that COVID-19 placed the older populations, especially those in NHs, at greater risk for infection, hospitalization, and death than any other age group. The Centers for Disease Control and Prevention (CDC, 2023a) reports that individuals aged 65–74 are 65 times more likely to die due to COVID-19 than younger populations. The pandemic also exacerbated financial strains on NHs, with escalating costs associated with direct care, infection prevention, and control measures such as personal protective equipment (PPE), testing kits, and cleaning materials. NHs also faced challenges in maintaining occupancy rates and struggled with increased staff absences (Simoni-Wastila et al., 2021). Given this brief introduction, my research delves into fundamental issues on NHs and their deficiencies, and morbidity and mortality of COVID-19, with philosophical and theoretical foundations.

## **Methodology and interpretation using research theory.**

This study is quantitative and uses the numerical treatment of NHDCs and other measurable variables such as staffing levels, NH characteristics, and resident outcomes among others, and their impact on quality of living and quality of care within NHs..

# **Theoretical Framework**

Systems are everywhere around us and are being studied in all fields such as biology, physics, and social sciences. The GST advocates that systems fundamentally share common attributes (von Bertalanffy, 2015). GST also posits that a comprehensive examination of the system, and its inner relations is more desirable and insightful than looking separately at its singular components and overlooking connections (von Bertalanffy, 2015). The pictorial representation of the theoretical framework is shown below.

A diagram of a system

Description automatically generated

## Summary of the theoretical framework.

The schema of the theoretical framework can be composed of inputs that interact with each other and interact with the environment around them to feed the core throughputs of the system. The core throughputs (or operations) then yield the outputs that circulate back through the feedback loop and the environment, seeding back to the inputs. The representation also shows the connectedness between the system, its boundaries, and its environment.

## Identification and application of the major constructs in this research.

GST can be thought of as a framework for understanding complex systems and phenomena (von Bertalanffy, 2015). The modern form of the GST was proposed in 1936 by the biologist Ludwig von Bertalanffy and further developed by Ross Ashby (Drack & Pouvreau, 2015). In the paradigm of GST, NHs are viewed as systems, encompassing all the various components such as residents, staff, physical environment, nursing and physicians’ services, operations and processes, resources, and more. systems could be further broken down into subsystems such as registered nurses (RNs), nursing assistants (CNAs), and licensed practical nurses (LPNs). Interactions among and between the components of the system represent the throughput of the system (von Bertalanffy, 2015). In this research, these throughputs represent vital variables related to NHs such as NHDCs, overall quality of care, and resident and family satisfaction. The interaction between these variables could lead to emergent properties in the system in the form of outputs. Examples of these outputs this study intends to consider are the morbidity and mortality of COVID-19.

# **Research questions and hypotheses**

## Research Question:

*Is there a case for distributional cost-effectiveness analysis in NHDCs? A quasi-experimental study.*

As an extension of the cost-effective analysis (CEA), distributional cost-effectiveness analysis (DCEA) is a framework concerned with the integration of health inequality within the economic assessment of interventions in the health sector. As a methodology, DCEA emphasizes understanding and evaluating the fair distributional impacts of health interventions among groups, regions, and strata. DCEA ensures that health policies and interventions are evaluated with an equity lens, considering the potential disparities in health outcomes across different population subgroups (Asaria et al., 2016). Theorizing NHDCs as an intervention aims at improving the quality of care and reducing abuse and neglect, this question seeks to understand the distribution of NHDCs pre- and post-COVID-19 based on three fundamental strata of nursing homes: racial composition of residents, ownership, and multiple chronic conditions among residents. The alternative hypotheses for the third question are:

1. Hypothesis One:

There is a case for distributional cost-effectiveness analysis evidenced by the difference in the incidents of NHDCs among facilities with different racial compositions (Black, White, Asian (ACS), & Tribal).

1. Hypothesis Two:

There is a case for distributional cost-effectiveness analysis evident by the difference in the incidents of NHDCs among facilities with different ownership statuses (private, non-private, governmental).

1. Hypothesis Three:

There is a case for distributional cost-effectiveness analysis evident by the difference in the incidents of NHDCs among facilities with multiple chronic conditions among residents.

## **Description and the source of the data.**

The data to be used in this research is coming from the following national datasets:

1) The official CMS datasets used on Medicare.gov. Specifically, the Online Survey Certification and Reporting (OSCAR) and Certification and Survey Provider Enhanced Reports (CASPER). These datasets allow users to compare the average performance level of NHs in certain areas of care for Medicare-certified skilled nursing facilities and NHs nationwide. The CMS publishes this data on a monthly basis under a broader classification of nursing homes and rehabilitation services.

2) Long-term Care Focus (LTCFocus) is a product of the Shaping Long-Term Care in America Project conducted at the Brown University Center for Gerontology and Healthcare Research. LTCFocus provides state and county-level data on NH care for a wide window of the years 2000 to 2020. The goal of LTCFocus is to allow researchers to trace relationships between state policies, local market forces, and the quality of long-term care.

3) The County Health Rankings and Roadmaps (CHR&R) is a research initiative of the University of Wisconsin-Madison Population Health Institute with support from the Robert Wood Johnson Foundation. CHR&R provides data, evidence, guidance, and examples to build awareness of the multiple factors that influence health in growing community power to improve health equity. The program produces the annual County Health Rankings, which rank the health of nearly every county in the nation.

# **V. Main variables of interest and their operationalization**

The GST guides the selection of the main variables and their operationalization. Assuming that nursing homes are open systems, as opposed to closed systems, there are six major constructs in the GST:

1. The system: this represents the NH, which is operationalized here through the federal provider number as part of the CMS provider data. The system in this study is observed at multiple points of time using the variable of time inters of the year.
2. The operational environment in this research is the collective macroeconomic variables such as unemployment, income, and poverty level in the county.
3. Boundaries are operationalized in this research as the microeconomic aspects of the nursing facility. Boundaries are operationalized in this research as A) the K-tags deficiency citations issued in violation of the CMS regulations. These requirements pertain to adopted codes of the buildings, construction, services, egress, and smoke, among others. Currently, there are 224 deficiencies identified under the K-tag. Another microeconomic variable is B) the total amount of monetary penalties imposed upon the facility by the state surveyors due to noncompliance with CMS regulations and guidelines. The assumption here is that more monetary penalties would impact the nursing home income. The literature shows that there is an association between income level and health expenditure (Moscone & Tosetti, 2010; Halıcı-Tülüce et al., 2016; Baltagi et al., 2017). C) the emergency preparedness deficiencies (E-tags). Currently, there are 27 deficiencies categorized under the E-tag. These deficiencies pertain to the issues related to emergency systems, plans, policies and procedures, communications, and training of fire and safety guidelines.
4. The input variables that will be used in this research are staffing in terms of hours per resident day (HPRD), case mix, bed size, payer mix, i.e., percentage of Medicare and Medicaid residents, ownership type (for-profit, non-profit, and governmental), chain-based (yes/no), occupancy rate, hospital-based facility (yes/no).
5. In this research, transformations are represented by the total score, scope, and severity of the health-related NHDCs (F-tags).
6. The are five outputs of this research: 1) the 5-star rating, 2) claim-based quality measures, 3) minimum dataset (MDS)-based quality measure, 4) the mortality rates of COVID-19, and 5) the morbidity rates of COVID-19.

The following table presents the operational definition of the variables I will use in this research:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Description | Type | GST Construct | Source |
| Id | Federal Provider Number | Nominal | System | CMS |
| County | Name of the county | Category | Environment | All |
| Year | Year of the data | Nominal | System | All |
| Unemployment | % of the unemployed labor force | Ratio | Environment | CHR&R |
| Poverty | % of children in Poverty | Ratio | Environment | CHR&R |
| inequality | 80th to 29th Income Percentile | Ratio | Environment | CHR&R |
| Uninsured | % of uninsured adults | Ratio | Environment | CHR&R |
| Costs | Healthcare costs in the county | Interval | Environment | CHR&R |
| Income | Median household income | Interval | Environment | CHR&R |
| Rural | % of people living in rurality | Ratio | Environment | CHR&R |
| Population | Number of people living in the county | Interval | Environment | CHR&R |
| K-Tags | Number of K-tag deficiency citations | Interval | Boundary | CMS |
| E-Tags | Number of E-tag deficiency citations | Interval | Boundary | CMS |
| Penalties | Total amount of penalties | Interval | Boundary | CMS |
| HHI | Herfindahl-Hirschman index | Interval | Boundary | CMS |
| Staffing | Hours per resident day (HPRD) | Interval | Inputs | LTCFocus |
| Acuity | Acuity index | Interval | Inputs | LTCFocus |
| Payer | % of Medicare & Medicaid residents | Ratio | Inputs | CMS |
| Ownership | For profit, non-profit, or government | Category | Inputs | CMS |
| Chain | Chain-based NH facility | Category | Inputs | CMS |
| Occupancy rate | (Total residents / Total beds) × 100 | Ratio | Inputs | LTCFocus |
| Hospital | Hospital-based NH facility | Category | Inputs | LTCFocus |
| Health\_Score | Score of health deficiency citations | Interval | Transform. | CMS |
| Health\_Severity | Severity of health deficiency citations | Category | Transform. | CMS |
| Health\_Scope | Scope of health deficiency citations | Category | Transform. | CMS |
| 5-Star | the 5-star rating | Category | Output | CMS |
| Claims | Total claim-based quality measures | Interval | Output | CMS |
| MDS | Total MDS-based quality measures | Interval | Output | CMS |
| Morbidity | COVID-19 morbidity in NH | Interval | Output | CMS |
| Mortality | COVID-19 mortality in NH | Interval | Output | CMS |
| L.Penalties | Lagged total amount of penalties | Interval | Feedback | CMS |
| Observation | CMS observed facility | Category | Feedback | CMS |

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