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The Philippine Review of Economics

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Care workers' sense of responsibility, working conditions, and the quality of care in South Korea

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As countries like South Korea expand their paid care services, ensuring quality care has become critical. Since care work involves significant emotional labor, a worker's sense of responsibility for the care recipient's well-being affects the quality of care delivered. In this study, we explore this particular determinant of quality care that has been underexplored to better understand its nature. However, a worker's sense of responsibility or commitment level is not static and varies depending on various factors including working conditions. Using 2018 Korean childcare and eldercare survey data, we empirically examine the relationship between a worker's commitment levels and working conditions by conducting Tobit and generalized maximum entropy (GME) analyses. Results indicate that training, shorter commutes, predictable schedules, and easy interactions with the care recipient's family are associated with higher levels of commitment. Our findings highlight the importance of supportive working conditions in promoting quality care.

JEL classification: J13, J14, J81, D91, J28, J490
Keywords: quality of care, childcare, eldercare, paid caregivers, working conditions, South Korea

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1. Introduction

As populations have grown, the demand for care services has also increased. Governments in middle- and high-income countries have responded by expanding paid care services, including childcare, early childhood education, and long-term care for older adults in need of care. A significant portion of unpaid care work, however, still falls on family members, with women shouldering much of the workload. In Korea, for example, the average weekly time spent caring for children and older adults in need of care exceeds 50 hours (Kang et al. [2021]; Cha et al. [2022]; Suh [2021]). One reason for the continuing heavy reliance on unpaid care is the concern about the quality of paid care services, making families less willing to substitute paid services for family caregiving. Studies on childcare in Korea show that the lack of affordable care of adequate quality has compelled even dual-earning households to rely heavily on women's unpaid care labor (Kim and Jeong [2006]; Sung [2018]). Adult children, particularly daughters and daughters-in-law, are opting to provide eldercare themselves, citing severe concerns regarding the quality of paid care as the main reason for this choice (Choi and Kim [2013]; Lee [2018]; Song [2014]).

This persistent reliance on women's unpaid labor worldwide to meet care needs has serious economic, social, and welfare consequences. Women face long working hours and stress as they try to balance paid work and caregiving, particularly among low-income workers (Himmelweit [1995]; England [2005]; Folbre [2011]). This reliance reinforces gender gaps in the labor market by decreasing women's labor force participation and earnings. In Korea, women's unpaid workload has kept its female labor force participation rate below those of other OECD countries (OECD [2021]; Statistics Korea [2023a]). Moreover, the reliance on women's unpaid care labor has contributed to the ultralow fertility rate in Korea, which has an adverse long-term impact on economic growth, social security systems, and reproduction.[1] For these reasons, governments must address not only the need for accessible care services but also for good quality care.

There is good reason for the concern about the quality of paid care. Caregiving is distinct from other types of paid care services in that it requires personal attention, is typically provided on a face-to-face basis, and is often for persons needing assistance in performing daily activities and bodily functions [Waerness 1984]. These features make the paid care sector particularly susceptible to quality problems [Folbre 2006]. While some argue that paid care workers may be unlikely to provide the same quality of care and emotional support that a loving family member or kin can offer [Moon and Cha 2020], others point to a contrasting view—due to their specialized training, paid care workers can be equally, or more, effective in providing quality care [Banuri et al. 2019].

[1] In 2021, it dropped to 0.81 births per woman, which is way below the 2.1 births per woman replacement rate and is now the lowest in the world.

If appropriately trained, such workers may be better able to provide the type of care that, say, an older adult with worsening dementia needs.

In this paper, we explore factors that may influence the quality of paid care services. In particular, we focus on a less studied factor, namely, the worker's sense of responsibility for the well-being of the care recipient. This sense of responsibility felt by the caregiver is, in our view, the key to providing good quality care. Commitment or a strong sense of responsibility in the delivery of care services plays a critical role in determining the quality of care work, whether paid or unpaid. Moreover, a care worker's sense of responsibility for the recipient may increase as more time is spent together, but it can also decline over time as stressful working conditions take their toll on the caregiver. Long working hours, long commute times, inadequate training, job insecurity, and difficulty in dealing with the recipient's family members can all adversely affect a worker's level of commitment.

To better understand care workers' commitment, we estimate the relationship between care workers' expressed level of responsibility towards the care recipient's well-being and their working conditions in South Korea. We examine the extent to which this sense of responsibility is associated with the working conditions of the caregiver, such as job security, work schedule predictability, and adequacy of training, as well as with care work intensity and the nature of the relationship with the recipient and the recipient's family. In focusing on this critical factor that affects the quality of care, we fill a gap in the literature. Using the population-weighted 2018 Care Work and the Economy Project survey data collected by Gallup Korea among 600 childcare and eldercare workers, we undertake Tobit and general maximum entropy (GME) analyses.

This paper proceeds as follows: Section 2 examines the role of worker's sense of responsibility in quality care provisioning, while Section 3 discusses the relationship between care workers' sense of responsibility and their working conditions. Section 4 presents our case study set in Korea, including the data collection and analytical methods used. Finally, Section 5 concludes with policy implications based on the findings of this study.

2. Context: the role of worker's commitment in quality care delivery

Caregiving, whether for young children or older or disabled adults, is a fundamental aspect of human life that facilitates the development of individuals, the continuity of social relations, and the reproduction of the labor force [Folbre 2011]. In the context of providing quality care, care workers must offer not only sufficient practical care but also enriching emotional support to recipients. Care work involves the utilization of communication skills, emotional exertion, and a strong sense of commitment or responsibility for the well-being of those receiving care (Tronto [1998]; Steinberg [1999]). For these reasons, the caregiver's own well-being is inseparable from the quality of care provided (Folbre [2006];

Nelson [2010]; Himmelweit [1995]). This factor, however, is often overlooked in assessing the quality of care [Steinberg 1999].

Measuring the quality of care is challenging, owing in part to the subjective and context-dependent nature of care provision [Nelson 2011].[2] Nevertheless, one consistent ingredient of quality care across diverse contexts and subjective opinions is the presence of a strong sense of responsibility in the care worker. Whether it is in the context of childcare or eldercare, a care worker's sense of responsibility influences the level of effort that care workers provide and their interactions with the care recipients (Tronto [1987]; Folbre and Weisskopf [1998]; Nelson [1999]; England [2005]; Meagher [2007]; Himmelweit and Land [2010]). This relationship between worker's commitment and job performance has been explored in various settings, including healthcare (Somers and Birnbaum [1998]; Brooke et al. [1988]; Teng et al. [2009]; Ruano et al. [2012]), but it has received less attention in the context of eldercare and childcare.

3. Understanding a care worker's sense of responsibility

One's sense of responsibility determines a care worker's approach and attitude in performing fundamental tasks such as dressing, feeding, bathing, administering medication to the care recipient, and addressing their emotional and developmental needs. In addition, it shapes the kind of relationship the care worker develops with recipients, and it ensures that care work is performed at a high level and with the recipient's best interest in mind [Nelson 1999]. Childcare workers committed to the well-being and development of the children in their care are likely to approach their duties with enthusiasm, motivation, and a positive attitude. Similarly, eldercare workers with a strong sense of responsibility are more likely to take time to listen to the older adult's stories and provide comfort when the care recipient is distressed [Eaton 2005].

A care worker's sense of responsibility itself reflects several factors or characteristics of the individual, such as the capacity for empathy, patience, and conscience. These intrinsic factors help care workers develop a positive relationship with the families of care recipients. Getting along with parents is crucial for high-quality childcare services (Garrity and Canavan [2017]; Zulauf-McCurdy and Zinsser [2022]). Similarly, a positive relationship between eldercare workers and older adults who receive care enables emotional and social support in addition to practical care (Walsh and Shutes [2013]; Teshuva et al. [2019]; Timonen and Doyle [2010]).

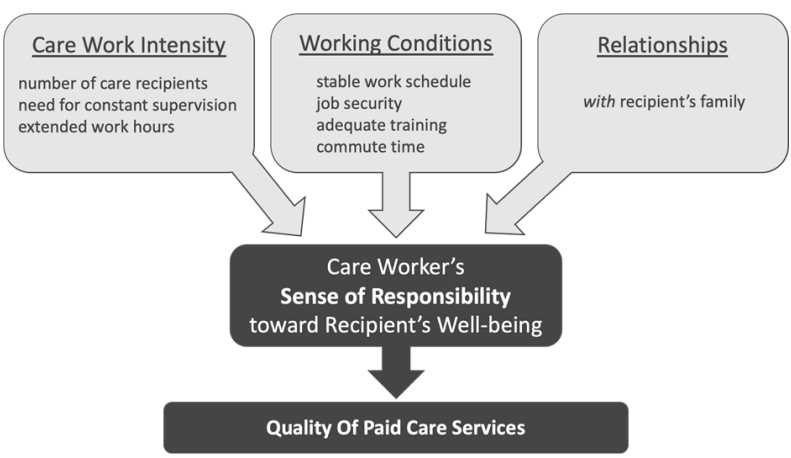
Working conditions can strengthen or erode a worker's sense of responsibility in affecting the quality of care. For example, studies have shown that adequate

[2] Quality care service provisioning depends on a variety of factors, as noted in the literature (O'Kane [2005]; Hotz and Xiao [2011]; Bowblis and Ghattas [2017]). These include: a) a robust care infrastructure, b) professional development and training, c) stringent standards, and d) effective regulations.

staffing (in the case of nursing homes and daycare centers), lower care recipient-worker ratios, job security, and supportive management are associated with higher quality care in both childcare and eldercare settings (Blau [2000]; de Schipper et al. [2006]; Bjørnestad and Os [2018]; Totenhagen et al. [2016]; Shin and Hyun [2015]; Cho et al. [2020]; Kwon and Hong [2017]; Holden et al. [2011]; Harrington et al. [2012]; Perruchoud et al. [2021]). Conversely, unpredictable work hours, job insecurity, long commute times to one's place of work (as in Korea), and the absence of benefits can worsen a worker's healthy work-life balance and adversely affect his or her commitment level [Folbre and Weisskopf 1998], and therefore, the quality of care delivered. Intensely demanding care work can lead to worker burnout and negatively impact a care worker's mental health (Linnan et al. [2017]; Kumagai [2017]), resulting in higher absenteeism and turnover [Barford and Whelton 2010].

Ongoing professional development and training programs for care workers are also essential in equipping workers with the knowledge and skills necessary to deliver quality care services (Burchinal et al. [2002]; de Schipper et al. [2007]; Bjørnestad and Os [2018]; Nolan et al. [2008]; Fernández-Puebla et al. [2022]; Sanjuán et al. [2023]). In contrast, inadequate or lack of training can lower a worker's confidence in performing their job, thereby negatively affecting their commitment level and, consequently, the quality of care delivered.

FIGURE 1. Understanding the factors influencing care worker's sense of responsibility



In Figure 1, we hypothesize that the care worker's level of responsibility towards the recipient's well-being is closely related to the realities of the work environment, including the working conditions, work intensity, and ease in dealing with the recipient's family. Concerning the latter, the direction of the relationship can be mixed: while higher intensity of care work is likely to be more stressful

and therefore can lead to burnout, possibly eroding a worker's commitment level, it can also strengthen the emotional bond between the care worker and recipient and thus heighten the care worker's sense of commitment (Kim et al. [2018]; Kim and Yeom [2016]). Care workers with a strong sense of responsibility may also be willing to take on intense care jobs, such as caring for persons with severe dementia or immobility.

4. The case of childcare and long-term care workers in Korea

4.1. Background

By 2060, Korea's population aged 65 and over is predicted to exceed 80 percent of the working-age population [OECD 2020]. Over the last decade, its population of older adults aged 80 and over has more than doubled. Alongside Korea's rapid population aging, the total fertility rate (TFR), i.e., the number of children born to a typical woman over her lifetime, has consistently declined since 1960, reaching a record low of 0.84 births per woman in 2020,[3] with the total number of 272,337 births compared to 444,849 in 2010 (Figure 2). These demographic shifts have raised significant economic and social concerns about the country's future labor supply, pensions, economic growth, and social reproduction. There has also been a steady increase in women's labor force participation, and rising living standards over the last few decades have increased demand for quality care services, such as enriched and educationally focused childcare and quality eldercare services. Now, the government is expected to provide affordable and quality eldercare. According to the 2002-2018 national social statistics survey, only 27 percent of Koreans agreed that the family should be solely responsible for caring for older adult family members in need of assistance [Kim 2019].

In recent years, the Korean government has made significant investments in improving care provisioning for children and older adults who need assistance with daily living. The universal childcare system, which includes daycare, nursery schools, and after-school programs, was further expanded in 2018 with the establishment of a cooperative childcare program rooted in the traditional Korean concept of *poom-asi*—taking care of children in neighborhoods in Korean society [Ministry of Gender Equality and Family 2012]. The long-term care insurance (LTCI) system has also been improved, with an increase in the number of in-home care services and a reduction in waiting times. In 2018, Korea's Ministry of Health and Welfare released a community care plan, focusing on customized care services in local communities [Ministry of Health and Welfare 2020a].

[3] In 2020, South Korea's population declined for the first time, with the number of births down 10 percent from 2019 [Lee 2021]. In 2021, Korea's TFR dropped even further to 0.81; the global average fertility rate is 2.4, while the OECD average is 1.61 [OECD 2023a].

The plan is being piloted in 16 local governments from 2019 to 2022 [Ministry of Health and Welfare 2020b].

The Korean government's effort to expand and improve the country's care infrastructure is apparent in the steady increase of the country's Early Childhood Education enrollment rate and the rising number of long-term care (LTC) recipients (See Figure 2). This is also reflected in the growth of the LTC workforce, serving individuals that need assistance with daily living activities due to physical, cognitive, or functional impairments. The number of formal LTC workers doubled between 2010 to 2020, from 178,223 to 366,261.[4]

However, the working conditions for care workers in South Korea remain challenging and stressful. Care workers often have to manage complex tasks and relationships with care recipients, while facing low pay and job insecurity, long hours, and other challenges such as long commutes (Peng et al. [2020]; Suh [2020]; Kim et al. [2022]). As for family members who provide care, despite the expansion of government support and the rapid growth of the private care sector, their workload continues to be heavy [Cha et al. 2022].

Recent studies indicate that family caregivers view caregiving as a burden and experience with significant opportunity costs [Moon and Cha 2020]. As in other countries, the primary family caregivers in Korea are typically women who continue to bear a large share of the total care work, even with the utilization of paid care services (Choi et al. [2014]; Lee et al. [2015]; Song [2016]; Chung [2018]; Cha et al. [2022]). Before the COVID-19 pandemic, family members provided 48.3 percent of total childcare in South Korea [KICCE 2018]; more than a third of women in their 30s and 40s reported having to carry a double burden of care, that is, taking care of both their children and their older parent(s) in need [Song 2014]. Cultural practices, a work culture that involves long hours spent in jobs, and socially ascribed gender norms that expect mothers, daughters, and daughters-in-law to provide care for their children, older parents, and parents-in-law continue to persist.

The most cited reason, however, for the continued heavy reliance on family caregiving relates to the affordability and quality of paid care services (Kim and Jeong [2006]; Sung [2018]; Choi and Kim [2013]; Lee [2018]; Song [2014]). Persistent concerns about neglect and abuse by care workers, including daycare teachers and *yoyangbohosas*,[5] led to the implementation of monitoring protocols using surveillance cameras. However, it is still being determined if such protocols have led to higher usage rates of paid care services.

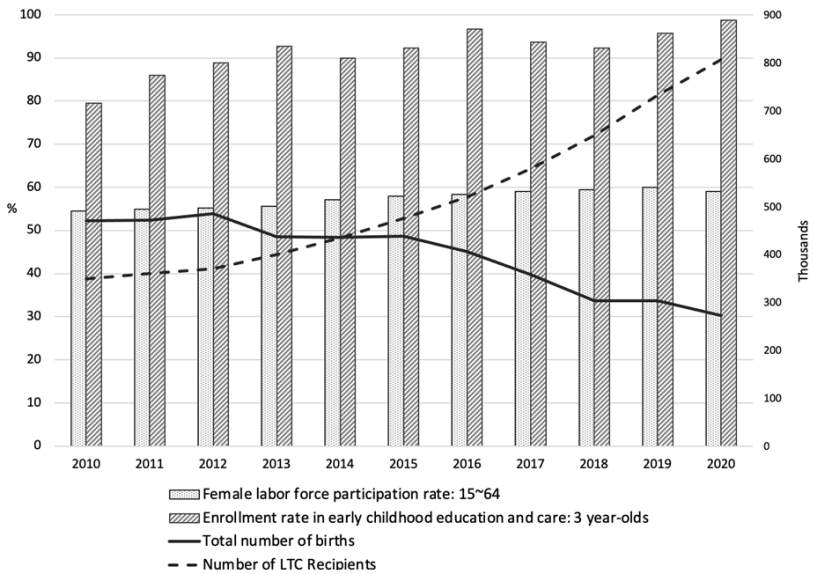
The heavy unpaid care workload on women has hindered Korea's progress toward achieving gender equality. Women returning from career breaks from

[4] Long-Term Care Resources and Utilization, Formal LTC workers (Headcounts), Health theme data, from OECD [2023b].

[5] The term *yoyangbohosa* is a newly defined job category in South Korea that refers to certified care workers in both homes and institutions.

childbirth or childcare often re-enter the labor market as non-regular workers with low-paying jobs. The gender wage gap continues to be one of the largest among OECD countries, at 31.5 percent in 2020 compared to the OECD average of 12.5 percent (in 2019) [OECD 2023c]. Additionally, women's labor force participation rate has also stagnated, hovering between 55 percent to 59 percent over the last decade (2010–2020).

FIGURE 2. Demographic and workforce trends in the context of Korea's Early Childhood Education (ECE) and Long-Term Care Insurance (LTCI) systems



Sources: Statistics Korea [2023a]; OECD [2023]; Statistics Korea [2023b]; National Health Insurance Corporation [2023]

These trends are puzzling in a country where paid care services have been made widely available in recent years through government policies. That, in theory, should have reduced the unpaid care workload of women. This expectation has yet to materialize, however, due to serious concerns regarding the quality of paid care services available, which make families reluctant to substitute unpaid care with those purchased in the care market (Kim and Jeong [2006]; Sung [2018]; Choi and Kim [2013]; Lee [2018]; Song [2014]).

As the review of the literature in the previous section shows, existing studies on the quality of paid care services have examined several measurable factors, such as standards and regulations, care workers' training and education, and working conditions, while focusing on their potential impact on the quality of care delivered. The care worker's sense of responsibility for the recipient in their care, a pertinent ingredient in quality care provisioning, has received little attention in empirical studies involving childcare and eldercare.

Our case study focuses on this less-studied aspect of quality care. We examine the extent to which this is associated with their working conditions, such as job security, work schedule predictability, and adequacy of training, while taking into account the care worker's demographic characteristics, geographical context, the intensity of care work, and ease in dealing with the recipient's family.

4.2. Empirical analysis

4.2.1. Data description

Our analysis uses the 2018 Care Work and the Economy survey data collected by Gallup Korea. The sample consists of 300 eldercare workers and 300 childcare workers in public and private care institutions across South Korea, including Seoul/Metropolitan Area (Seoul, Incheon, Gyeonggi-do, and Gangwon-do), Chungcheong Area (Daejeon, Sejong, Chungbuk, and Chungnam), Honam Area (Gwangju, Jeonbuk, and Jeonnam), Gyeongbuk Area (Daegu and Gyeongbuk), and Gyeongnam Area (Busan, Ulsan, and Gyeongnam). The sampling design of childcare and eldercare workers took into account the stratification by geographical region and occupational categories (institutional worker, home-based worker, or informal worker) [Jun et al. 2021].[6] To make the samples representative of the childcare and long-term care workers population in South Korea, we constructed inverse sampling probability weights using care workers' data by geographical region and type of care arrangement using information from the 2017 Day Care Centre Statistics Yearbook [National Statistics Office 2017] and the 2017 Long-Term Care Insurance Statistical Yearbook [National Health Insurance Corporation 2017].[7] Annex 1 describes the methodology for constructing the sampling weights.

Responses to the survey question "How much responsibility do you feel for the health and safety of your care recipient(s)?" is used as our measure of expressed commitment or sense of responsibility by the care worker. There are some caveats about the survey data that are worth mentioning. First, the primary variable of interest is based on the respondent's self-report response, bounded between zero percent (not my responsibility at all) and 100 percent (entirely my responsibility). Moreover, the data is cross-sectional; hence, we cannot evaluate the direction of change over time.

Table 1 provides the characteristics and working conditions of the care workers in our sample. Reflecting the dominance of women in Korea's paid care sector, a vast majority (95 percent) of the respondents are women, with eldercare

[6] Eldercare workers in institutional facilities work in nursing homes and daycare centers, excluding hospitals. Home-based eldercare workers work in the older person's home and are funded by National LTCI. In contrast, informal eldercare workers are hired by families or older people without written or formal contracts, e.g., live-in carers. Institutional childcare workers are employed in public, private, or corporate daycare centers. Home-based childcare workers are hired through agencies, while families hire informal childcare workers without formal contracts, e.g., informal babysitters.

[7] For informal workers, the regional informal worker population was estimated using the informal sector share of GDP. See Annex 1 for details.

workers being older on average (54.4 years) compared to childcare workers (47.3 years). Most of the care workers completed at least high school education (71.8 percent), live with a spouse (85.3 percent), and are in dual-earning households (77.2 percent). The majority work in a metropolitan area (73.3 percent), and about half (50.4 percent) are regular or contract employees with a signed contract.

TABLE 1. Characteristics and working conditions of care workers, by type of worker

	All Workers	Childcare Workers	Eldercare Workers
A. Worker Characteristics			
Average Age (years)	52.5	47.3	54.4
Care Work Experience (mean, in years)	4.7	5.62	4.4
Gender (% distribution)			
Female	94.8	95.0	94.8
Education (% distribution)			
No schooling	0.1	0.0	0.2
Primary	1.9	1.5	2.0
Middle School	6.3	0.5	8.4
High School	71.8	56.6	77.3
College	19.3	40.1	11.8
Graduate	0.6	1.3	0.4
Number of care work licenses (% distribution)			
0	16.2	35.4	9.3
1	68.0	46.0	76.0
2	12.1	14.0	11.4
3+	3.6	4.6	3.3
Has a Spouse (% distribution)			
Yes	85.3	87.0	84.7
Dual-Earner Household (% distribution)			
Yes	77.2	83.2	75.1
B. Working Conditions			
Number of care recipients (mean)[1]	2.7	2.3	2.9
Work hours (mean)[2]	39.4	37.3	40.2
Average commuting time to work (mean in minutes)[3]	46.2	41.3	48
Need to watch recipient at all times (% distribution)[4]			
Yes	49.0	68.9	41.7
Extra work hours (% distribution)[5]			
Yes	26.7	36.6	23.2
Metro (% distribution)[6]			
Yes	73.3	78.3	71.5

TABLE 1. Characteristics and working conditions of care workers (continued)

	All Workers	Childcare Workers	Eldercare Workers
Care work is physically difficult (% distribution)[7]			
Yes	65.7	57.6	68.7
Has a predictable work schedule (% distribution)[8]			
Yes	61.2	61.5	61.1
Has regular holiday leaves (% distribution)[9]			
Yes	80.6	83.2	79.7
Family is relatively easy to deal with (% distribution)[10]			
Yes	28.9	37.5	25.4
Regular or contractual employee with a signed contract (% distribution)[11]			
Yes	49.6	38.2	53.7
Institution-based worker (% distribution)[12]			
Yes	51.6	32.7	58.4

Note: Calculated using the 2018 CWE-GAM Korean Childcare and Eldercare Workers Survey data based on respondent's answer to the following survey questions:
1. How many care recipients have you taken care of over the past week?
2. Over the past month, how many hours per day did you do care work on average? (Sum of weekday and weekend hours)
3. How much time does it take to commute to work from your home on average?
4. I need to watch my care recipient at all times (agree/strongly agree =1, yes)
5. I work more hours than the standard number of hours (agree/strongly agree=1, yes)
6. Opening survey question completed by survey investigator on the location of care work provided.
7. In general, how much physical difficulty do you have taking care of the child or elderly person? (Slightly/very difficult=1, yes)
8. There are times when my work schedule gets cancelled without notice (strongly /somewhat disagree=1, yes)
9. I can apply for holidays when I want to (strongly/somewhat agree=1, yes)
10. It is very difficult to deal with the care recipient's family members (strongly/somewhat disagree=1, yes)
11. What type of employment do you have at your current workplace (regular employee or contract up to 2 years), and have you signed an official written labor contract related to your current care work (yes or don't know)?
12. Main workplace (Work at an institution or care center)

Childcare workers, on average, have a higher percentage of college degree holders (40.1 percent) compared to eldercare workers (11.8 percent). About 65 percent of childcare workers and 91 percent of eldercare workers work with at least one professional license in terms of work experience; childcare workers have more years of care work experience on average (5.6 years) compared to eldercare workers (4.4 years). Most eldercare workers (58.4 percent) are institution-based and spend more time commuting to work, whereas childcare workers are more likely to work in the care recipient's home.

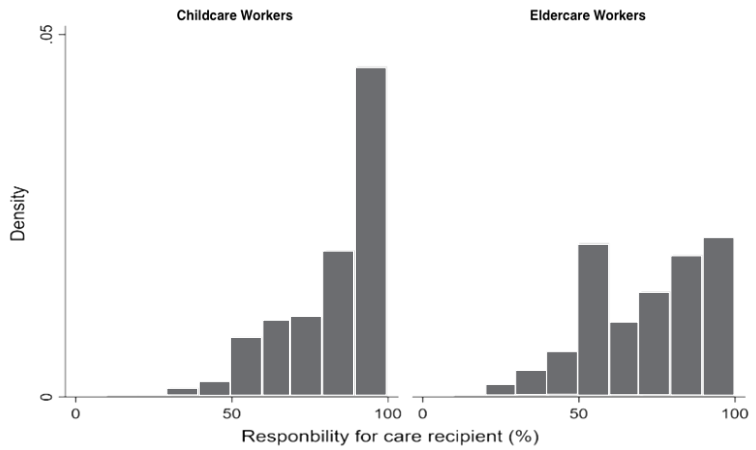
On average, the care worker respondents in our sample care for two to three recipients, work about 40 hours a week, and spend roughly 46 minutes commuting daily. Compared to childcare workers, eldercare workers tend to care for more recipients and work more hours per week. About a quarter (26 percent) of the

sample reported working more hours than the original employment agreement stated. Nearly 40 percent reported having an unpredictable work schedule. More than half of the paid care workers face job insecurity (i.e., they don't have a signed labor contract or regular employment) and lack work schedule predictability. Less than one-third of respondents agreed that it is relatively easy to deal with the recipient's family, which we use as a proxy for the relationship with the recipient's family.

In terms of care work intensity, about half (49 percent) of the paid care workers reported that their care recipient requires constant supervision (i.e., the recipient needs to be "watched at all times") during working hours. This is more pronounced among childcare workers (68.9 percent) than among eldercare workers (41.7 percent). More than a quarter of care workers responded that they worked more than the standard 40 hours; nearly two in three responded that care work is physically difficult. These findings suggest that care work is intense and challenging for a significant portion of the workforce, with some notable differences between eldercare and childcare.

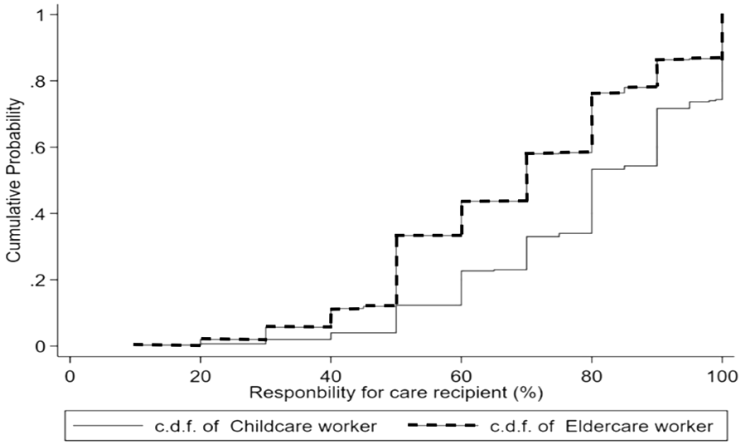
The frequency and cumulative distributions of our main variable of interest, i.e., level of expressed commitment or sense of responsibility of the care workers, are given in Figures 3 and 4, respectively, and ranges in value from zero percent (not my responsibility at all) to 100 percent (entirely my responsibility). Overall, the mean percentage level of responsibility reported by the respondents is 71.6 percent. Childcare workers tend to report a higher level of responsibility (79.5 percent on average), compared to eldercare workers (68.7 percent on average), as shown in Table 2.

FIGURE 3. Frequency distribution of care worker's reported level of responsibility for well-being of recipient, by type of care worker



Sources: Care Work and the Economy Project Field Work Data [2021a]; Care Work and the Economy Project Field Work Data [2021b].

FIGURE 4. Cumulative distribution of care workers' reported level of responsibility for well-being of recipient, by type of care worker



Sources: Care Work and the Economy Project Field Work Data [2021a]; Care Work and the Economy Project Field Work Data [2021b].

TABLE 2. Average care workers' reported level of responsibility for care recipient, by type of worker (in percent)

Responsibility for Care Recipient	Mean	Std. Dev
All Workers	71.60	20.60
Childcare Workers	79.50	17.30
Eldercare Workers	68.70	21.00

Note: Statistics are based on 2018 CWE-GAM Korean Childcare and Eldercare Worker Survey respondent's answer to the following question: "*How much responsibility do you feel for the health and safety of your care recipient(s)?*" The responses ranged between zero percent (not my responsibility at all) and 100 percent (entirely my responsibility).

4.2.2. Methodology

An underlying argument of this paper is that the commitment or sense of responsibility exhibited by a care worker constitutes a crucial element in providing quality care services. This commitment is influenced by the realities of the care worker's working conditions, as well as by intrinsic characteristics of the care worker, such as patience and consciousness, for which we do not have direct measures. In this section, we test the hypothesis that better working conditions are associated with a higher level of expressed commitment toward the recipient's well-being. We use the following indicators for working conditions, including work schedule stability, job security, which is proxied by a dummy variable indicating regular employment status or having either a labor contract for up to two years or a signed written agreement, and adequacy of training, proxied by a

dummy indicating if a worker lacks adequate training. We also consider the care worker's commute time based on care workers' concern regarding long commutes to and from their place of work.[8]

Since our dependent variable, a care worker's sense of responsibility, is bounded between zero percent and 100 percent, we use two estimation methods that can accommodate this censoring of the data. We use Tobit regression and the censored Generalized Maximum Entropy proposed by Golan et al. [1997].[9] For the Tobit model, we assume that the observed dependent variable,

$$y_i = \begin{cases} 0 \; if \; y_i^* < 0 \\ y_i^* \; if \; 0 < y^{t*} \leq 1 \\ 1 \; if \; y_i^* > 1 \end{cases} \tag{1}$$

That is, our observed values y_i are bounded between zero and one for the underlying latent variable y_i^* where y_i^* which is the level of responsibility the care recipient would theoretically "choose" if the response was not bounded between zero percent and 100 percent). We then estimate the model using a maximum likelihood (ML) approach.

Given the small sample size, we also conduct an entropy-based econometric analysis. This method is deemed appropriate because it does not require restrictive assumptions on the distribution of the error terms, unlike conventional linear regression models, and is a more efficient estimator than the ML estimator. Specifically, it draws inferences from limited or small data using the available observed information to yield a non-uniform distribution with minimal assumptions that is consistent with the observed sample moments [Golan 2007].

In this study, we follow the generalized maximum entropy (GME) approach by Golan et al. [1997]. The entropy of a probability distribution $\tilde{p}$ is given by:

$$H(\tilde{p}) = -\sum(p_i \log p_i) \tag{2}$$

where $0 \cdot \log 0 \stackrel{\text{def}}{=} 0$. We seek to maximize this objective function (the entropy) subject to constraints including the constraint ($\sum_i p_i = 1$). The probability distribution is over the vector of parameter estimates $\widehat{\beta}$. For each parameter estimate $\widehat{\beta_k}$, we propose a support $[-\widehat{\beta_k}, \widehat{\beta_{nk}}]$ centered on zero. We then maximize the entropy subject to the data and the added constraint that

$$y_i = \begin{cases} 0 \; if \; y_i^* \leq 0 \\ 1 \; if \; y_i^* \geq 1 \end{cases} \tag{3}$$

[8] Based on one of the authors' field interviews with and roundtable presentations by representatives from Seoul Supporting Center for Eldercare Workers, Childcare Workers Chapter of the Korean Confederation of Trade Unions, Seoul LTC Care Workers Association, and Korean Domestic Workers' Association, at the International Conference on Empowerment of Care Workers: Issues and Challenges, Seoul National University, Seoul, February 25, 2019. See Moon et al. [2021] for qualitative methodology and survey instruments used in the Care Work and the Economy project's fieldwork in South Korea.

[9] See Annex 2 for further discussion of Generalized Maximum Entropy.

In addition to the proxy variables and indicators for working conditions, we include the following variables of interest, namely, commute time and care work intensity as proxied by a) whether the recipient requires constant supervision, b) the number of recipients currently being cared for, and c) regular occurrence of working extra hours. Controls for selected worker *i* characteristics, such as life cycle (age and age-squared), experience proxied by the number of years since the start of care service employment, years of education, whether the worker resides in a metro area, and if the worker has a spouse, are included along with job characteristics such as whether performing eldercare or childcare and the ease in dealing with care recipient's family.

The basic model is expressed as:

$$\begin{aligned} Y_i = {} & \beta_0 + \beta_1 Age_i + \beta_2 Age_i^2 + \beta_3 Educ_i + \beta_4 Experience_i + \beta_5 Spouse_i + \\ & \beta_6 Metro_i + \beta_8 Eldercare_i + \beta_9 ExtraHours_i + \beta_{10} NumRecipients_i + \\ & \beta_{11} NeedsConstantWatch_i + \beta_{12} CommuteTime_i + \beta_{13} StableSched_i + \\ & \beta_{14} FamilyRelation_i + \beta_{15} SecureJob_i + \beta_{16} InadequateTraining_i + \epsilon_i \end{aligned} \quad (4)$$

where Y_i is the observed (reported) level of responsibility, Age_i is the care worker's age, $Educ_i$ is the worker's years of education, $Experience_i$ is the worker's years of experience in providing care work (calculated from the survey question: "years since care work first started"), $Spouse_i$ is a dummy variable for whether the care worker has a spouse, $Metro_i$ is a dummy variable for whether care work is performed in a metro area, $Eldercare_i$ dummy indicates whether the worker is providing eldercare (as opposed to childcare), $ExtraHours_i$ dummy indicates whether or not the care worker regularly works extra hours more than was originally agreed to (self-reported), $NumRecipients_i$ refers to the number of care recipients being cared for, $NeedsConstantWatch_i$ dummy indicates whether the recipient needs to be watched at all times (i.e., care worker response's is "agree" or "strongly agree"), $CommuteTime_i$ refers to weekly average commute time, $StableSched_i$ dummy indicates whether the care worker has a predictable (or stable) work schedule (self-reported), $FamilyRelation_i$ is a dummy variable on whether the care worker reports that it is easy to deal with recipient's family members, $InadequateTraining_i$ dummy indicates if the worker lacks adequate training, $SecureJob_i$ dummy indicates whether the worker is a regular (full-time) employee, a contract worker with up to two-year labor contract or a dispatched employee with a signed written agreement, and ϵ_i is the random error term.

4.2.3. Results and discussion

The results of both Tobit and GME models using the entire sample (both eldercare and childcare workers) are reported in Table 3. The standard errors of the estimates of the latter are smaller since the GME estimators are more efficient. Our results are consistent for both regression analyses; however, we focus our discussion on the GME results.

TABLE 3. Tobit and Generalized Maximum Entropy (GME) regression estimates: association between care worker's level of responsibility for recipient's well-being and working conditions, by type of worker

Variables	All Care Workers	
	Tobit	GME
Age	-1.823* (1.097)	-0.091 (0.889)
Age-squared	0.0174 (0.0112)	0.000 (0.009)
Years of education	1.325** (0.634)	1.417*** (0.504)
Years since first started care work	0.558 (0.349)	0.085 (0.245)
Has a spouse	5.762 (3.752)	1.291 (2.944)
Metro area worker	-9.574*** (2.685)	-5.777*** (2.207)
Institution-based worker	-0.957 (2.665)	-2.712 (2.345)
Eldercare worker	-5.024** (2.489)	-5.093** (2.326)
Worked extra hours	6.464** (2.651)	5.424** (2.147)
Number of recipients under one's care	-1.376 (0.881)	-0.926 (0.790)
Need to watch recipient at all times (agree and strongly agree)	5.185** (2.278)	3.455* (1.975)
Daily average commute time (minutes): to and from work	-0.0918** (0.0415)	-0.08** (0.036)
Predictable work schedule	10.29*** (2.192)	7.946*** (2.018)
Easy to deal with recipient's family members	5.465** (2.339)	4.117** (2.065)
Job security proxy[1]	5.329** (2.544)	3.982 (2.434)
Received enough training (somewhat or strongly disagree)	-3.520* (2.814)	-4.242** (2.356)
Constant	98.68*** (26.75)	59.848 (22.594)
Observations	600	600

[1] Dummy variable for worker who is a regular employee, with a signed contract up to two years or a dispatched employee with a signed labor contract.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Several of the working conditions variables examined are statistically significant. A predictable work schedule is associated with a 7.9 percentage point increase at one percent level of statistical significance in the reported level of commitment towards the safety and well-being of the care recipient, while a lack of adequate training leads to a 4.24 percentage point decline at five percent level of statistical significance. The ease in dealing with the recipients' family is associated with a 4.1 percentage point increase at a five percent level. This indicates the importance of maintaining a predictable work schedule that helps avoid sudden and unanticipated changes in the care worker's schedule. Adequate training is also paramount in reducing accidents and building the worker's confidence in dealing with emergencies. The results also imply that relationships with the recipient's guardians (parents or children) can affect the care worker's level of commitment.

Table 3 results also show that longer commute times are associated with lower reported levels of commitment; that is, an increase in commute time is associated with an 0.08 percentage point decrease in the respondent's sense of responsibility. These results give support to the Korean care workers' associations' concern about the lack of travel allowance that compels workers to use the cheapest, albeit longer, means of travel to their workplace and about their need for adequate training.

Interestingly, working more than the standardized 40 hours a week is associated with a 5.4 percentage point increase in the worker's sense of responsibility, while constant supervision (i.e., the need to watch the care recipient at all times) is associated with a 3.4 percentage point increase. We acknowledge that the relationship between the worker's sense of responsibility (the dependent variable) and these care work intensity indicators may be bi-directional. On the one hand, as workers attempt to meet the intense caregiving needed by the recipient, their sense of commitment also increases. At the same time, workers who feel a strong sense of responsibility for recipients may self-select into or stay in positions where the recipient requires constant supervision.

Table 3 results suggest that higher education may positively influence workers' sense of responsibility, with an additional year of schooling correlating with a 1.4 percentage point increase (significant at the one percent level). Conversely, living in a metropolitan area is associated with a 5.8 percentage point decrease (significant at the one percent level). This may, in part, reflect the regional differences in educational attainment, professional training, and working conditions and confirm the findings of other studies. For instance, Kim and Kim [2017] found that care workers in urban areas face poorer work conditions than rural areas in Korea, especially those caring for older adults.

Another possible explanation is the market density effect, i.e., there are more job opportunities and competition among care workers in urban areas compared to rural areas, where opportunities tend to depend on kinship and community networks. Overall, performing eldercare is associated with a lower sense of responsibility

toward the safety and well-being of the recipient compared to childcare. This may reflect the differences in the performance of eldercare and childcare, with more complexity and challenges in the case of caring for older persons.

We next examine the possibility that the relationship between the worker's sense of responsibility and working conditions may differ for eldercare and childcare workers. We conduct separate Tobit and GME regressions for the childcare and eldercare subsamples, and the results are given in Table 4. Note that the standard errors in the subsamples' estimates are larger compared to those for the whole sample in Table 3 due to the smaller sample sizes. We note that working extra hours is positively associated with a higher reported level of commitment for both childcare and eldercare workers by 5.1 and 6.6 percentage points, respectively.

TABLE 4. Tobit and Generalized Maximum Entropy (GME) regression estimates: association between worker's level of responsibility for recipient's well-being and working conditions, by type of care worker

	Childcare Workers		Eldercare Workers	
Variables	**Tobit**	**GME**	**Tobit**	**GME**
Age	-1.399 (1.327)	0.356 (1.183)	-2.095 (2.108)	1.256 (2.214)
Age-squared	0.0153 (0.0141)	-0.004 (0.013)	0.0187 (0.0203)	-0.013 (0.021)
Years of education	1.112 (0.866)	**1.647**** **(0.698)**	**1.432*** **(0.818)**	1.034 (0.752)
Years since first started care work	0.394 (0.386)	-0.067 (0.311)	0.813 (0.503)	0.656 (0.435)
Has a spouse	**-6.661*** **(3.665)**	-7.307 (4.586)	**8.683**** **(4.369)**	**7.635**** **(3.803)**
Metro area worker	**-7.192*** **(4.105)**	-3.198 (3.284)	**-9.583***** **(3.168)**	**-7.513**** **(2.962)**
Institution-based worker	1.336 (3.430)	-3.141 (3.194)	-1.083 (3.621)	-0.745 (3.544)
Worked extra hours	**5.111*** **(2.881)**	**5.106*** **(2.792)**	**7.159**** **(3.622)**	**6.583**** **(3.317)**
Number of recipients under one's care	**-2.697**** **(1.146)**	-1.403 (1.218)	-0.884 (1.108)	-1.161 (1.094)
Need to watch care recipient at all times (agree and strongly agree)	**9.908***** **(2.972)**	3.597 (2.907)	3.523 (2.813)	3.656 (2.68)
Daily average commute time (minutes): to and from work	-0.0666 (0.0465)	**-0.083*** **(0.047)**	**-0.120**** **(0.0579)**	-0.094 (0.059)
Predictable work schedule	1.984 (2.860)	3.542 (2.934)	**13.12***** **(2.669)**	**11.803***** **(2.795)**
Easy to deal with recipient's family member	1.668 (2.617)	1.776 (2.756)	**7.730**** **(3.079)**	**8.113***** **(3.11)**

TABLE 4. Tobit and Generalized Maximum Entropy (GME) (continued)

	Childcare Workers		Eldercare Workers	
Variables	**Tobit**	**GME**	**Tobit**	**GME**
Job security proxy[1]	**8.158****	3.454	3.673	3.547
	(3.495)	(3.695)	(3.041)	(3.211)
Received enough training (somewhat or strongly disagree)	**-6.034***	**-6.78***	-2.694	-2.702
	(3.179)	**(3.532)**	(3.389)	(3.143)
Constant	100.0***	56.398**	98.59*	16.47
	(34.76)	(27.948)	(53.53)	(58.56)
Observations	300	300	300	300

[1] Dummy variable for worker who is a regular employee, with a signed contract up to two years or a dispatched employee with a signed labor contract.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The effect of commute time is negatively associated with childcare workers' level of commitment at ten percent level, but not for eldercare workers. This is likely because most childcare workers in Korea work in daycare centers, often far from their residences. In contrast, eldercare workers have more flexibility to work with recipients within proximity to their homes. Lack of adequate training is also associated with a 6.8 percentage point decline in the childcare worker's level of commitment at ten percent level, but not for eldercare workers. This underscores the importance of training and professional guidance in improving the quality of paid childcare services.

Results in Table 4 show that having a predictable work schedule and ease in dealing with the recipient's family member(s) are associated with an increase of 11.8 percentage points and 8.1 percentage points, respectively, in the level of commitment among eldercare workers, but have no statistically significant effect on childcare workers. This disparity may be due to the more complex and heterogeneous nature of eldercare compared to childcare. Workers caring for older persons are, therefore, more likely to experience difficulties or dilemmas not only in dealing with the recipient's family members but also directly with the recipient. Moreover, older adults in need of care may experience sudden changes in mental, emotional, and physical conditions without warning. Since most eldercare workers visit their clients at home, maintaining a predictable work schedule can be challenging depending on the mobility and health condition of the recipient. Such challenges can eventually lead to heightened stress or exhaustion on the part of the care worker, which can affect her level of commitment.

4.2.4. Addressing endogeneity issues

The preceding discussion notes that some control variables suffer from endogeneity problems, particularly those indicating that the worker "usually works extra hours than discussed" and "need to watch care recipients at all times."

That is, workers who are intrinsically more committed or dedicated might self-select into jobs where they need to work extra hours or constantly watch the recipient, and so the control variables about working conditions are not independent of the disturbance term. This contrasts with the general expectation that more intense working conditions are associated with lower quality of care (as proxied by the worker's level of commitment variable) and may highlight the interrelated nature of the factors influencing the quality of care.

We address this problem by focusing on the subsample of care workers who work for institutions that match them to their care recipient, as compared with those who are self-employed.[10] This subsample includes both workers who provide care work at a facility and workers who provide home care but work through an institution.[11] About 22 percent of home care workers and 55 percent of institutional care workers are assigned to their recipients by their institution. We acknowledge that self-selection could still be a problem if institutions match the most committed workers to recipients who need the most care but assume institutional matching will reduce the bias compared to cases when the care worker has chosen the care recipient on their own.

Another potential source of endogeneity is that less dedicated workers might leave if the job is too demanding, leaving the more dedicated workers to work with recipients who need more time or need to be constantly watched (a form of survivorship bias). We attempt to correct for this by adding a variable for years of experience in our regression. We note that we observe only the total years of experience rather than experience with the current care recipient. However, even controlling for total years of experience should reduce survivorship bias in our results.

We then conduct Tobit and GME regression analyses using this subsample; the results are given in Table 5. We note that "working longer hours than discussed" is no longer associated with a higher sense of responsibility to the recipient. Interestingly, however, the need for constant supervision remains statistically significant, suggesting that constant supervision of the care recipient may increase the care worker's sense of responsibility towards the recipient.[12]

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[10] Survey question: How did you meet the care recipient to whom you're currently providing care?

[11] We note that these variables can suffer from other forms of endogeneity. For example, care workers who feel less committed might refuse care work at higher rates when working conditions are intense, leaving only the more committed workers in our sample (survivor bias). In addition, workplaces might try to match more dedicated workers with more difficult cases, in which case, our assumption that "workplace assignment" would serve as a randomizing mechanism no longer holds.

[12] For the subsample of institutionally assigned workers, we also examine the group mean of the reported level of responsibility for the bottom 20 percent of workers by experience (those with zero to two years of experience) and the top 20 percent of workers by experience (those with eight to 30 years of experience). The mean level of responsibility for those with zero to two years of experience is 72.9 percent, and for those with eight to 20 years of experience is 72.2 percent. The differences in means are not statistically significant. Note that the cases whereby spending more time or watching the care recipient causes the care worker to feel more responsible for the recipient is not endogenous. We believe this is the causal effect of spending more time with the recipient.

TABLE 5. Tobit and GME regression estimates for institutionally assigned subsample

Variables	Childcare Workers		Eldercare Workers	
	Tobit	GME	Tobit	GME
Age	-2.630 (1.659)	2.116 (4.626)	**-11.37***** (2.675)	1.256 (2.214)
Age-squared	**0.0347*** (0.0196)	-0.031 (0.054)	**0.108****** (0.0270)	-0.027 (0.048)
Years of education	**3.904****** (1.279)	-1.263 (2.651)	-0.849 (1.264)	2.777 (2.037)
Years since first started care work	-0.248 (0.483)	0.318 (1.02)	0.612 (0.648)	0.587 (0.977)
Has a spouse	-5.027 (5.839)	-0.633 (13.537)	**25.78****** (5.717)	-1.306 (9.191)
Metro area worker	**-13.51**** (5.952)	-10.12 (13.1)	-3.497 (5.089)	-7.909 (7.239)
Worked 40 hours or more	0.444 (8.109)	-2.494 (20.005)	8.762 (6.842)	-9.501 (10.636)
Worked extra hours	**3.097*** (4.313)	2.525 (10.288)	-0.415 (5.769)	-6.248 (8.91) -4.04
Number of recipients under one's care	-1.226 (2.184)	-1.979 (4.705)	**-3.433****** (1.709)	(2.904) 3.048
Need to watch care recipient at all times (agree and strongly agree)	**14.81****** (5.662)	0.847 (12.265)	**13.20****** (4.983)	(7.063) 0.162
Daily average commute time (minutes): to and from work	-0.0651 (0.0825)	0.075 (0.176)	-0.0630 (0.0662)	(0.134) -40.84
Predictable work schedule	2.719 (4.395)	4.993 (11.435)	**16.84****** (3.968)	(6.908) -4.818
Easy to deal with recipient's family member	7.098 (4.606)	-2.755 (10.466)	**9.345****** (4.437)	(7173) -9.485
Job security proxy[1]	1.779** (4.731)	-7.603 (14.089)	-0.136 (5.477)	(8.223) -11.051
Received enough training (somewhat or strongly disagree)	**-17.46****** (5.495)	7.643 (14.785)	-5.506 (5.319)	(7.272) -0.368
Constant	**72.92*** (39.21)	13.58 (93.294)	**345.8****** (68.50)	(139.753) -9.501
Observations	200	200	250	250

[1] Dummy variable for worker who is a regular employee, with a signed contract up to two years or a dispatched employee with a signed labor contract.
Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

We note a third potentially endogenous variable in our analysis: ease in dealing with the care recipient's family members. Care workers who appear to be more patient and more conscientious could be better treated by family members than others. Thus, the quality of care provided by the care worker might be causing the difficulty or ease of dealing with family members rather than the other way around. On the other hand, family members might try to take advantage of care workers who seem more dedicated, saddling them with more care responsibility and souring the relationship between care workers and family members. Given data limitations, we are unable to address this particular issue in our study, and so, our findings should be treated with caution. Future research can explore this relationship and help shed light on the relational aspect of care work.

5. Concluding remarks

Despite the wide availability of paid care services and a large care workforce, a heavy reliance on family care—performed mainly by women for young children and older adults in need of care—continues to persist in middle- and high-income countries such as South Korea. This reliance is fueled by concerns regarding the perceived quality of paid care services, making it challenging for families to transition from traditional unpaid care to paid care services. Significant developments in the past few decades, such as aging populations, and rising healthcare needs, further signal the growth of care needs affecting not only high-income countries, such as South Korea, but also middle-income countries, such as the Philippines. To address this pressing issue, it is crucial for governments to implement regulations and invest in the provision of affordable and high-quality childcare and eldercare services.

Our research has examined a relatively unexplored aspect of quality care, namely, the worker's sense of responsibility for the care recipient. The emotional labor involved in care work makes it essential for care workers to have a strong commitment to the recipient's well-being [Nelson 1999]. This commitment is influenced by working conditions and other factors, as our case study of Korean childcare and eldercare workers reveals.[13]

Policies that promote decent working conditions are crucial in attracting and retaining care workers who possess a robust sense of responsibility and commitment towards their recipients, thereby facilitating the provision of high-quality care services. Essential measures to achieve this may include ensuring living wages, establishing predictable work schedules, providing pension and health benefits, offering adequate training opportunities, implementing respite care for care workers, granting commute travel allowances (where applicable), and establishing guidelines

[13] These findings should be viewed with some caution, however, due to data limitations. We hope future research on this critical issue will focus on collecting better data.

that foster positive relationships between care workers and the families of care recipients. By implementing policies that improve the working conditions of care workers alongside government support for care services, policymakers can address the challenges faced by middle- and high-income countries in providing affordable, quality childcare and eldercare. Such measures also have the potential to alleviate the heavy workload primarily borne by female family caregivers and facilitate a smoother transition towards a more balanced utilization of paid care services.

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Annex 1. Construction of survey weights

The eldercare and childcare worker survey data collection in Korea for the Care Work and the Economy (CWE-GAM) Project was performed in 2018 using a purposive sampling design [Jun et al. 2021]. The 600 samples were evenly split between eldercare and childcare workers. For eldercare workers, of the 300 workers surveyed, 150 samples were allocated to institutional workers, 100 to in-home care workers and 50 to informal workers. These samples were further stratified by region namely, Seoul Metro, Chungcheong, Honam, Gyungbuk, and Gyungnam. For childcare workers 100 samples were allocated to institutional workers (50 to public daycare centers, 50 to private daycare centers), 100 samples were allocated to in-home care workers and 100 samples were allocated to informal workers. These samples were again further stratified by region.

TABLE 1.1. Sample allocation

	Eldercare Workers			Childcare Workers			
	Institution	In-home	Informal	Institution		In-home	Informal
				Public	Private		
Seoul Metro	80	42	10	25	27	20	20
Chungcheong	20	11	10	6	6	20	20
Honam	18	23	10	8	5	20	20
Guyngbuk	16	10	10	5	4	20	20
Guyngnam	16	14	10	6	8	20	20
Total	150	100	50	50	50	100	100

We weighted the purposive sample used in the paper to make it representative of the eldercare and childcare worker population in Korea by calculating the inverse sampling probability weight for each observation. For institutional eldercare workers, the relevant subpopulation was the number of institutional workers in each region published in the *2017 Eldercare Facility Statistics* [Ministry of Health and Welfare 2017]. For in-home eldercare workers, the relevant subpopulation was the number of in-home care workers in each region as published in the *2017 Long-Term Care Insurance Statistical Yearbook* [National Health Insurance Corporation 2017]. For childcare workers, the relevant subpopulation was the number of care workers (excluding administrative staff and instructors) for each type of institution (private facility, private in-home, or public) in the region, as published in the *2017 Day Care Centre Statistics* [National Statistics Office 2017].

TABLE 1.2. Survey weights for eldercare workers

	Institutional Workers			In-Home Workers			Informal Workers		
Region	Total Workers N_i	Workers Surveyed n_i	Weight pi	Total Workers	Workers Surveyed	Weight	Total Workers	Workers surveyed	Weight
Seoul/Metro	47,688	80	596.10	10,955	42	260.83	19,372	27	717.49
Chungcheong Area	11,969	20	598.45	2,736	11	248.73	5,010	6	834.97
Honam Area	11,206	18	622.56	6,005	23	261.09	3,383	5	676.62
Gyungbuk Area	9,707	16	606.69	2,409	10	240.90	3,376	4	843.93
Gyungnam Area	9,373	16	585.81	3,739	14	267.07	5,918	8	739.71
Total	89,943	150		25,844	100		37,055	50	

TABLE 1.3. Survey weights for childcare institutional care workers

Region	Public	Non-Profit	Workers Surveyed	Weight	Private	Workers Surveyed	Weight
Seoul/Metro	2,179	218	25	95.88	6,988	27	258.81
Chungcheong Area	195	277	6	78.67	1,614	6	269.00
Honam Area	191	426	8	77.13	1,326	5	265.20
Gyungbuk Area	212	203	5	83.00	1,532	4	383.00
Gyungnam Area	351	193	6	90.67	2,352	8	294.00
Total	3,128	1317	50		13,812	50	

TABLE 1.4. Survey weights for childcare in-home and informal care workers

	In-Home			Informal		
Region	In-Home	Workers Surveyed	Weight	Informal	Workers Surveyed	Weight
Seoul/Metro	10,998	20	549.90	9,382	20	469.08
Chungcheong Area	2,591	20	129.55	2,426	20	121.31
Honam Area	1,767	20	88.35	1,638	20	81.92
Gyungbuk Area	1,424	20	71.20	1,635	20	81.74
Gyungnam Area	2,741	20	137.05	2,866	20	143.29
Total	19,521	100		17,945	100	

The number and distribution of informal care workers across Korea is unknown, so we use the estimates on the number of informal childcare and eldercare workers using the method in Suh [2020] paid care sector in Korea study. We assumed that the distribution of informal care workers among childcare and eldercare worker subpopulation follows the same pattern as that of formal care workers. That is, about a third were employed in childcare while the rest were employed in eldercare. We next assumed that the regional distribution of workers follows the regional GDP share. The relevant subpopulation for informal care workers is the estimated number of informal workers in each region for each type of care work (childcare or eldercare).[14]

The sampling probability p_i for an observation in subpopulation i is simply the number of samples allocated to the subpopulation n_i divided by the size of the subpopulation N_i.

$$p_i = \frac{n_i}{N_i} \qquad \text{(c1–1)}$$

The inverse sampling probability weight is $1/p_i$.

Annex 2. Discussion of the Generalized Maximum Entropy (GME) model

In the case of the GME model, we assume that the $\widetilde{\beta}$ are discrete random variables drawn from a support space $\mathcal{L} \subset \mathcal{R}^k$ where k is the number of parameters in the problem. Then $\widetilde{\beta}$ maybe expressed as

$$\widetilde{\beta} = \begin{bmatrix} z_1 & 0 & \cdot & 0 \\ \cdot & z_2 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & z_k \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \\ \cdot \\ p_k \end{bmatrix} \qquad (2.1)$$

Similarly, we assume that the errors from the model are being drawn from some discrete bounded distribution. Thus, the error distribution maybe written as

$$e = V_w = \begin{bmatrix} v_1 & 0 & \cdot & 0 \\ \cdot & v_2 & \cdot & 0 \\ \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & v_k \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \cdot \\ w_k \end{bmatrix} \qquad (2.2)$$

where w are the probability weights associated with each outcome. Then our objective function becomes (bold-faced variables indicate vectors or matrices)

[14] For example, to obtain the survey weight for informal childcare workers in Chungcheong Area: we use the total number of informal childcare workers: 27,500; and Chungcheong's share of Korean GDP: 13.45 percent; to get estimated number of informal childcare workers: 3,700 = 27,500*13.45 percent. We then divide this by the number of informal childcare workers surveyed in Chungcheong (20) to obtain the survey weight 2700/20 = 185.

$$\max_{p,\, w_1,\, w_2,\, w_3} \; -\boldsymbol{p}^T \log \boldsymbol{p} - \boldsymbol{w}_1^T \log \boldsymbol{w}_1 - \boldsymbol{w}_2^T \log \boldsymbol{w}_2^T - \boldsymbol{w}_3^T \log \boldsymbol{w}_3 \tag{2.3}$$

subject to the constraints

$$\boldsymbol{y}_1 = \boldsymbol{X}_1 \boldsymbol{Z}_p + \boldsymbol{V}_1 \boldsymbol{w}_1 \tag{2.4}$$

$$\mathbf{0} = \boldsymbol{\mu}_1 \leq \boldsymbol{X}_2 \boldsymbol{Z}_p + \boldsymbol{V}_2 \boldsymbol{w}_2 \tag{2.5}$$

$$\mathbf{1} = \boldsymbol{\mu}_2 \geq \boldsymbol{X}_3 \boldsymbol{Z}_p + \boldsymbol{V}_3 \boldsymbol{w}_3 \tag{2.6}$$

and the adding up constraints described in Golan et al. [1997] eq. 4.6 – 4.8. Note that our responses are bound on both sides, so we have an additional data constraint and adding up constraint.

The estimation procedure requires the researcher to make several choices. For the support space $\boldsymbol{Z}$, we choose

$$\boldsymbol{Z} = \begin{bmatrix} -100 & -50 & 0 & 100 \\ -100 & -50 & 0 & 100 \\ . & . & . & . \\ -100 & -50 & 0 & 100 \end{bmatrix} \tag{2.7}$$

where $\boldsymbol{Z}$ is of dimension 20×5. Golan et al. [1997] show that if $Z_{1k} \leq \beta_k \leq Z_{Hk}$, the estimates are not very sensitive to the specification of the support space. (In our case, $H = 5$ and we assume the β_k are bound between [-100,100]. For the error supports, we use the 3-sigma rule for v_1 and choose uniform errors between [-10,10] for v_2 and v_3. That is:

$$V_2 = V_3 \begin{bmatrix} -10 \\ 0 \\ 10 \end{bmatrix} \tag{2.8}$$

We test with alternative specifications of V_2 and V_3 and note they do not significantly change the result.