

Häcker, Jasmin; Hackmann, Tobias

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## LOS(T) in long-term care: Empirical evidence from German data 2000-2009

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## DISKUSSIONSBEITRÄGE DISCUSSION PAPERS

LOS(T) in Long-Term Care:  
Empirical Evidence from German  
Data 2000-2009

Jasmin Häcker  
Tobias Hackmann

No. 43 – May 2010

# LOS(T) in Long-Term Care: Empirical Evidence from German Data 2000-2009

**Jasmin Häcker\***

Research Center for Generational Contracts, University of Freiburg (Germany)

**Tobias Hackmann**

Research Center for Generational Contracts, University of Freiburg (Germany)

May 2010

## **Abstract**

Using microdata, i.e. representative samples of 114,403 German long-term care dependants (LTCDs) observed from 2000 to 2009 we give a comprehensive insight into the length of stay (LOS) in long-term care (LTC). Furthermore, this paper evaluates the effects of longevity on the LOS thus revisiting the debate on the validity of the competing theories of compression or expansion of morbidity in LTC. The analysis finds significant effects on the LOS when *age* is controlled for thus rejecting the time-to-death hypothesis. However, controlling for *assessment level* suggests an improved health status of LTCDs over time thus supporting the time-to-death hypothesis. An analysis of the mortality rates of LTCDs is to give insight into the opposing results. But the regression of mortality shows a divergence in the development of mortality rates for different disability levels. This is evidence to suggest that the “improved” health status in LTC is not only due to actual changes in the health status, but also a consequence of political meddling.

*Keywords: ageing; proximity to death; long-term care, length of stay*

*JEL Classification: I10, J14*

\* Correspondence to Jasmin Häcker, Research Center for Generational Contracts, University of Freiburg, Bertoldstraße 17, D-79098 Freiburg, Germany, Phone: 0049-761-203-2355, Fax 0049-761-203-2290.

E-Mail: [jasmin.haecker@vwl.uni-freiburg.de](mailto:jasmin.haecker@vwl.uni-freiburg.de).

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## 1 Introduction

The consequences of an ageing population have intensified the concerns about rising long-term care (LTC) expenditures in Germany. Not only will the growing elderly population undoubtedly increase the number of persons in need of LTC, but also a growing body of literature suggests that proximity to death as well as age per se are main drivers for LTC costs (Werblow et al. (2007) and Weaver et al. (2008)). While proximity to death captures the deterioration in health associated with the mortality process, age captures the health decline due to (multi-)morbidity. Thus, the use of LTC is not only concentrated at the end of life, but increasing longevity may also increase the per capita demand for LTC substantially.

Yet, a series of studies has shown decreasing prevalence of being LTC dependent of the elderly (see Manton and Gu (2001) and Spillman (2004) for the U.S. and Hackmann and Moog (2009) for Germany). Therefore, the implications of increasing longevity for LTC expenditures depend critically on the competing theories of compression or expansion of morbidity. As people live longer LTC expenditures will increase, but the pace of this increase will be determined by whether the onset of LTC dependency is being delayed at a greater, lesser, or equal rate to the changing rate of prevalence. In order to shed light on the cost development in the LTC sector, it has thus to be clarified whether the time-to-death hypothesis or the morbidity hypothesis prevails. The question which thesis holds in LTC decisively hinges on the development of the age-, gender- and disability-specific prevalence rates giving the ratio of long-term care dependants (LTCDs) of different age, gender and care or disability levels.

As illustrated by Hackmann and Moog (2009) the influencing variables for the prevalence rate are the incidence and the mortality rate. In their analysis, Hackmann and Moog (2009) find a decrease in incidence rates over time as well as a decline in overall mortality. The mortality of LTCDs, however, has so far not been assessed — a circumstance mainly due to a lack of data. A key contribution of this paper is to pinpoint the mortality rates of LTCDs, or rather the length of stay (LOS) in LTC.

Studies of the LOS in LTC for Germany are scarce.<sup>1</sup> While cross-sectional data are comprehensive, time series data are rare, partly because Germany's statutory long-term care insurance (LTCI) was only introduced in the year 1995. Nevertheless, documenting the LOS in LTC is an important factor in determining costs of LTC funders, especially as LTCI in Germany is based on the pay-as-you-go principle.<sup>2</sup> In the first few years after implementing LTCI in Germany, revenues exceeded expenditures, but for the past ten years fiscal problems have become immense. Although the tight financial situation has (so far) not been triggered by demographic change but are rather inherent in the system, there are major demography-induced challenges down the road. Considering constant age-specific prevalence rates of LTC the numbers of LTC patients will more than double, i.e. from 2.1 million today to 4.4 million in 2050.

This paper aims at giving full insight on the LOS in LTC. The analysis is conducted on 2000–2009 data of 114,403 LTCDs. It includes the consideration of different care or disability levels where disability depicts chronic dimensions of the deterioration in health. The latter is measured by limitations in

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<sup>1</sup> Prüß et al. (2006), Rothgang et al. (2008) and Seger et al. (2008) are basically the only ones making an approach on the LOS in LTC for Germany.

<sup>2</sup> The benefits are financed by an income-based system where all employees covered by the social security system and their employers have to pay equal contributions.

activities of daily living (ADL) and instrumental activities of daily living (IADL). Furthermore, the study explores how longevity influences the LOS in LTC.

The paper is structured as follows: chapter 2 provides a brief overview of the institutional setting of the German LTCI and the structure of the beneficiaries of LTCI. Chapter 3 describes the data. In chapter 4, the LTC history of people in need of LTC is determined according to the criteria *age*, *gender* and *care level* when initially classified for LTCI. Applying transition probabilities between the different care levels an average length of stay (ALOS) in LTC is determined. Finally, chapter 5 assesses the effects of age and proximity to death on the LOS in LTC. In comparison to other studies, e.g. Yang et al. (2003), Stearns et al. (2007), Werblow et al. (2007), and Weaver et al. (2008), who consider the effects of proximity to death, age and longevity on per capita LTC expenditures, this study examines the effects on the LOS in LTC, respectively. Since in the German LTCI system LTC history (i.e. the LOS in LTC accounting for different extents of care needed, respectively different disability levels) is closely related to per capita costs, concordant statements on LTC expenditures can be made. Also see Stearns et al. (2007), who — using a U.S. data set — show that the disability level significantly determines the costs of LTC. A summary and conclusions are provided at the end of this paper.

## 2 Institutional setting and structure of the German LTCI

The German legislature enacted a mandatory, universal social insurance program for long-term care — *Soziale Pflegeversicherung* — in 1995 that provides for nursing home and home care benefits for people of all ages without regard to financial status and covers roughly 90 percent of the population.<sup>3</sup> Although administered by the sickness funds, long-term care is fiscally separated from acute care. The long-term care insurance premium is uniform and fixed by law at 1.95 percent of gross salary, which is shared equally by employers and employees.<sup>4</sup> Only retirees pay the full premium.

In order to be entitled to claim benefits from LTCI an insured person must be defined as “frail”. The Social Security Code (*Sozialgesetzbuch, SGB*) XI defines a frail person as “a person who requires permanent, frequent or extensive help for a minimum period of approximately six months in performing a special number of ‘Activities of Daily Life’ (ADL, *grundlegende Aktivitäten des täglichen Lebens*) and ‘Instrumental Activities of Daily Life’ (IADL, *instrumentelle Aktivitäten des täglichen Lebens*) due to physical, mental or psychological illness or disability”. Three levels of disability are distinguished depending on the time required for care and the required frequency of assistance (see tab. 1). The eligibility criteria for each disability level are the same for institutional and home care. The Medical Review Board of the Statutory Health Insurance Funds (*Medizinischer Dienst der Krankenkassen, MDK*) performs the task of identifying, verifying, and assessing the severity of LTC a person needs, de facto entitling him/her to the respective benefits. Entitlement for LTCI is independent of age, however, almost 80 percent of the beneficiaries are 65+ and more than 50 percent are at least 80 years old.

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<sup>3</sup> The remaining 10 percent are insured in a congruent private system with identical benefit levels financed by individual premiums.

<sup>4</sup> Since the year 2005 insured people aged 23 and older have to pay an add-on contribution rate of 0.25 percent if childless. This additional contribution rate is supposed to “compensate” for intergenerational effects of childlessness and is the monetary amount to insure intergenerational equity.

**Tab. 1: Levels of Disability in Germany's LTCI**

Care level	ADL/IADL deficiencies	Frequency of assistance with ADL/IADL	Amount of assistance required for ADL/IADL
<b>Level I: substantial</b>	Two or more ADL limitations and need for help with IADL	ADL: at least once per day IADL: several times per week	Min. 90 minutes for combined ADL and IADL, with at least 45 minutes for ADL
<b>Level II: severe</b>		ADL: at least three times daily IADL: several times per week	Min. 3 hours for combined ADL and IADL, with at least 2 hours for ADL
<b>Level III: very severe</b>		ADL: day and night IADL: several times per week	Min. 5 hours for combined ADL and IADL, with at least 4 hours for ADL

ADL: activities of daily living; IADL: instrumental activities of daily living.

The LTCI benefits are set by law and vary by care level and institutional status. In general, beneficiaries may choose between home and institutional care. LTCDs deciding to carry on living in a private household further have the choice between cash or service benefits. LTCDs deciding to live in a nursing home are only entitled to service benefits. Nursing home coverage includes basic care, medical care, and therapeutic social activities, but not room and board or investment costs. Contrary to the German health care insurance, LTCI is organised as a partial coverage insurance, i.e. all benefits are capped or paid as lump sums (see tab. 2).<sup>5</sup> Thus, LTCI funds provide benefits that, in general, are not sufficient to cover the costs of formal care at home or in a nursing home.

**Tab. 2: Benefits paid for home and institutional care by LTCI in Germany, 2010**

Care level	Home care		Nursing home care
	cash benefit (monthly)	service benefit (monthly up to ...)	service benefit (monthly lump-sum)
<b>I</b>	<b>225 €</b>	<b>440 €</b>	<b>1,023 €</b>
<b>II</b>	<b>430 €</b>	<b>1,040 €</b>	<b>1,279 €</b>
<b>III</b>	<b>685 €</b>	<b>1,510 €</b>	<b>1,510 €</b>
<b>Hardship cases</b>	<b>-</b>	<b>1,918 €</b>	<b>1,825 €</b>

Until 2008, no regulations concerning how benefits were to be adjusted by the federal government existed. I.e., benefits were not even aligned with inflation. Only in 2008, a law specifying an adjustment path was enacted. This "path" however is only valid until 2012 — no arrangements have been made for the time after.

Because monthly costs per beneficiary are capped, program outlays do not depend on the amount of services used per person or provider payment levels, but instead, on whether a person is eligible, what care level he/she is categorized as having, and whether a beneficiary chooses home or

<sup>5</sup> LTCI has several cost-control mechanisms that distinguish it from acute care, which ensures that spending does not grow uncontrollably. If spending exceeds agreed-upon levels, deliberate political choices by government authorities are needed to balance funds; no automatic mechanisms have been built in. Both revenues and benefits are capped to some degree. Revenues are limited by the fixed contribution rate. On the benefit side, maximum monthly benefits per eligible person are fixed by disability level and setting. Finally, benefits do not automatically increase with inflation; they must be legislatively raised.

nursing home care, cash or services. The overwhelming majority of beneficiaries – 69 percent in 2009 – receive care outside of nursing facilities.<sup>6</sup> The actual number of beneficiaries was 2.1 million in 2009.<sup>7</sup> Germany's changing demographics will place strains on LTCI. The percentage of the population of age 80 years and older – the age group most likely to need long-term care services – in proportion to the 20 to 65 year-olds – the age group having the absolute highest contribution payments to LTCI – will increase from 8.5 percent to 27.7 percent from 2010 to 2050.<sup>8</sup> Besides the rising number of beneficiaries, their LOS in LTC will be crucial for the financial conditions of LTCI.

### 3 Data

The estimation of the length of stay (LOS) in long-term care (LTC) — in dependence of the disability level and care type, i.e. home care or institutional care — is based on a data set of the AOK Berlin.<sup>9</sup> This data set contains information of 167,210 insured LTC beneficiaries in the period from January 2000 to June 2009 with monthly frequency. In order to produce scientifically sound results concerning the LOS in LTC, we exclusively focus on new entrants in LTC, i.e. people becoming eligible for LTCI benefits within this time horizon. This reduces the number of persons being monitored to an absolute number of 114,403 persons. At each point in time, the data set allows assigning LTCI recipients to a disability level and to the type of care employed, i.e. home or nursing home care. Finally, the end of the LOS in LTC is defined by either the time of death (*dead*), the switch into a non-LTC state (*healthy*) or the time of censoring.<sup>10</sup>

To validate the quality of this data set, we compared the sample with the basic population of all LTCI beneficiaries in Germany, considering their distribution across different care levels and between the home and nursing home care sector. It shows that the distribution of LTC recipients of the sample depicts a high level of conformity to the basic population, as the maximum deviation comes to not more than 2.6 percentage points (see tab. 3). Moreover, the proportion of females among all LTCI beneficiaries ranges around 70.8 percent in case of the sample and around 67.6 percent considering the basic population. Within the sample, the average age of becoming LTC dependent is 72.9 (80.8) years for males (females). The Medical Review Board estimates the average age of “entrance” into LTC at 72.2 (78.8) years for males (females) for the basic population, correspondingly.<sup>11</sup> Due to the high level of consistency with the basic population we can report a

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<sup>6</sup> Among the LTCDs receiving home care 67 percent chose cash rather than services, although there has been a slight increase over the past few years in the proportion of beneficiaries choosing services or a combination of services and cash. The proportion varies by level of disability but is still quite high among the most severely disabled.

<sup>7</sup> Considering the 10 percent LTCDs of the private insurance system the absolute number of LTC beneficiaries amounts to 2.3 million.

<sup>8</sup> Own calculations based on the 12<sup>th</sup> coordinated population projection of the German Federal Statistical Office (2009).

<sup>9</sup> The AOK is the biggest health insurance company in Germany with 23 million insured persons and a market share of 23 percent and is split up into 15 independent federal insurance funders (December 2009) – more or less in conformity to the German federal states. Within the AOK Berlin, the absolute number of insured amounts to 712,000 persons. The AOK Berlin is the tenth biggest federal insurance in an informal ranking of all 15 federal insurances of the AOK in Germany.

<sup>10</sup> A LTCI beneficiary is defined to be censored in case the data set ends or there is a change in the insurance company.

<sup>11</sup> See Wagner and Bruckner (2003).

valid inference for the sample. Thus, the outcomes of this analysis are highly representative for the basic population of LTCI beneficiaries.

**Tab. 3: Distribution of LTC beneficiaries**

		AOK Berlin (Sample)	Basic Population (Germany)
Home Care	Level I	43.0%	40.4%
	Level II	22.9%	21.8%
	Level III	5.9%	6.6%
Nursing Home Care	Level I	9.1%	11.3%
	Level II	12.0%	13.4%
	Level III	7.1%	6.5%

Source: Own calculations based on data from AOK Berlin and Federal Statistical Office (2008).

## 4 Results

### 4.1 Descriptive Statistics

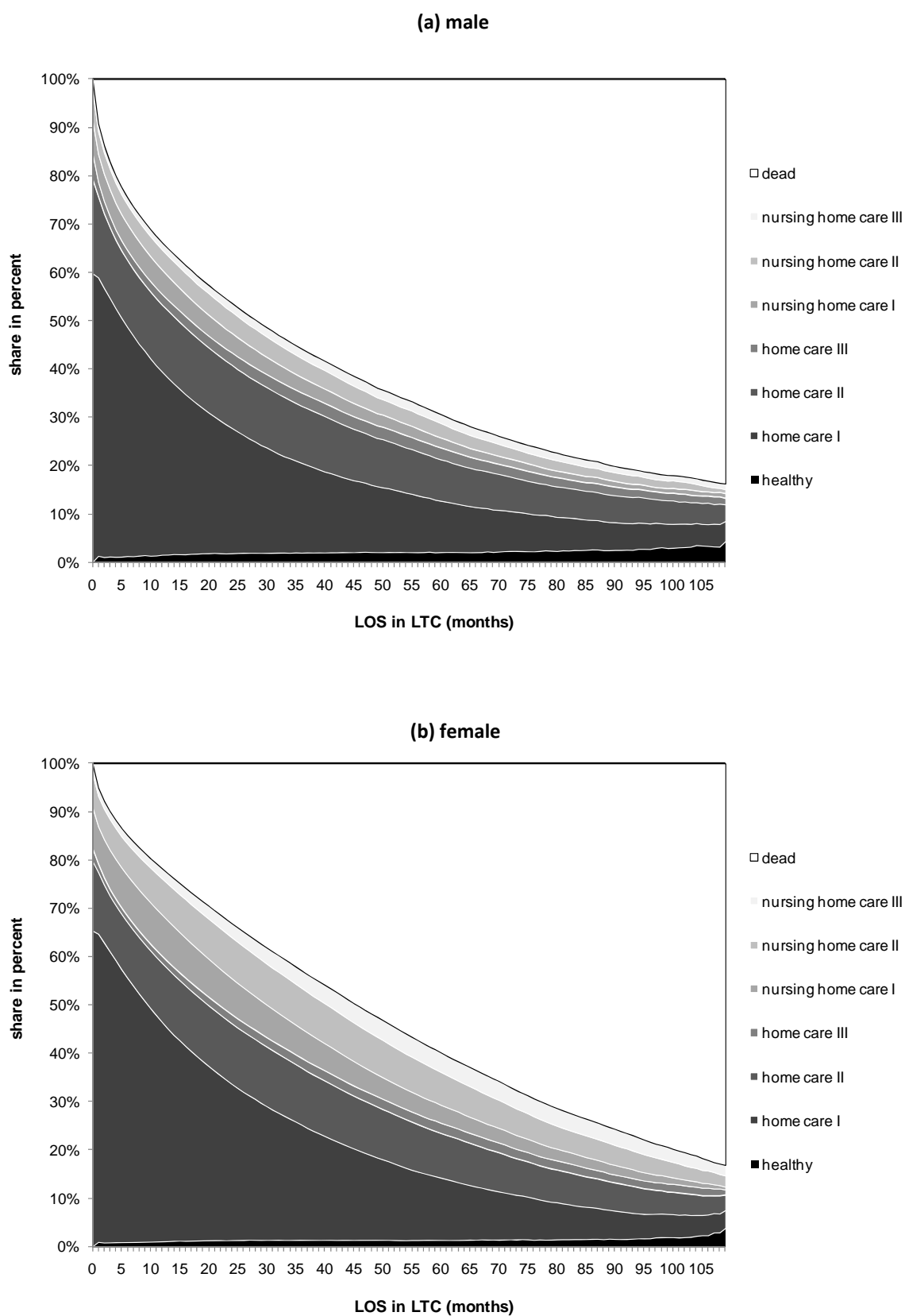
As mentioned earlier, the analysis of the specific LOS of LTCI beneficiaries has eight different states: *home care level I-III*, *nursing home care level I-III*, *healthy*, and *dead*.

Independently of the LTC state, we can see that men have a shorter LOS in LTC than women: Half of the male long-term care dependants (LTCDs) are dead after a period of 30 months — female LTCDs attain this state after 47 months (see also fig. 1). However, towards the end of the observation period, i.e. after 109 months, the difference in life expectancy between male and female LTCDs diminishes significantly. After a period of 109 months, 12 (14) percent of male (female) recipients are still alive and receive benefits from LTCI. 4.3 (3.8) percent of the male (female) LTCDs have left the state of LTC and find themselves in a *healthy* status. Additionally, it shows that considerably more women receive nursing home care compared to men.

Besides gender-specific differences in the LOS — or rather in the remaining life expectancy — in LTC one distinctive feature is the age of the beneficiaries. This shows, when separating LTCDs into age group “39 years and younger” and “40+”. Within the age group of the 0 to 39 year-olds 15.5 percent are *dead* after the period of observation of 109 months, while 46.2 percent are still in need of LTC and 38.3 percent are back in *health*. In this age group the main provision of LTC services is delivered by the home care sector.

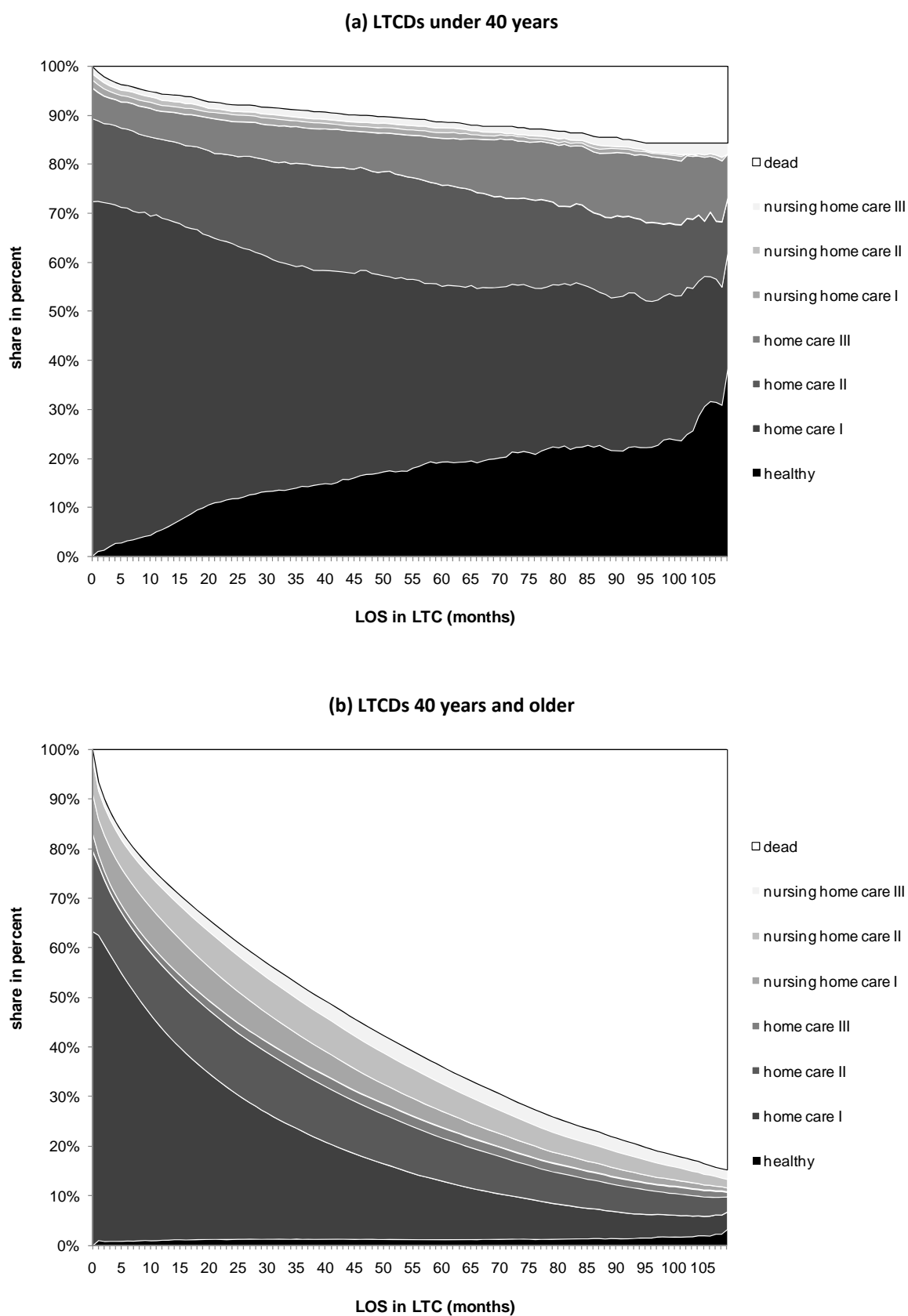


**Fig. 1: Gender-specific transitions between different states of LTC for the observation period**



Source: Own calculations based on data from AOK Berlin.

**Fig. 2: Age-specific transitions between different LTC states for the observation period**



Source: Own calculations based on data from AOK Berlin.

In contrast to this, 84.8 percent of the age group 40+ are *dead* after 109 months, 12 percent are still in need of LTC and only 3.2 percent have recovered and are back in *health* (see also fig. 2). As the further analysis focuses on LTC for the elderly, the age group 0 to 40 years will be excluded from the sample in what follows.<sup>12, 13</sup>

Considering the age group 40+, note that the LOS in LTC decreases rapidly with the age of the LTCDs. In the age group of the 60 to 70 year-olds 50 percent of the male (female) LTCDs are *dead* after 31 (64) months. In the age group 90+ this threshold value is already reached after 21 (34) months. Altogether, these results illustrate the fact that the factors *male* and *age* are major determinants for the extent of the LOS in LTC. So, being male and at a ripe old age decreases the LOS in LTC significantly, while being female and not too old of age promises a rather extensive LOS in LTC. The analysis further reveals that the ratio of nursing home to home care rises as LTCDs are getting older. To be more precise, the ratio of nursing home to home care is 0.24 (0.12) for male (female) LTCDs within the age group of the 40 to 60 year-olds and increases to an average of 0.66 (1.16) for male (female) LTCDs of age 90 years and older.<sup>14</sup>

The third and last major determinant for the course of LTC dependency and the LOS in LTC is the initial assessment level, i.e. the classification to one of the three disability levels of LTC. The level to which a LTCD is first assigned to is of vital importance for the LOS in LTC. Naturally, the higher the care level a LTCD is initially assessed to, the shorter the LOS in LTC. Being classified to disability level I, and choosing home care upon entering the LTC-dependant status, 50 percent of the male (female) LTC recipients are dead after 42 (56) months. However, being classified to disability level II, respectively to disability level III, when entering the LTC-dependant status, 50 percent of the male (female) LTC recipients are already dead after 17 (30) months, respectively after 3 (4) months.

In case the course of LTC dependency commences with nursing home care, the remaining life expectancy of a LTCD or rather the LOS in LTC is shorter than in case the course of LTC dependency starts with home care: Being classified as a level I or level II recipient upon first acquiring the LTC dependent status and choosing nursing home care sector, 50 percent of the male (female) LTCDs are dead after 28 (37), or 8 (19) months respectively. When LTC beneficiaries are first classified as level III dependants, 50 percent of the male (female) LTCDs are dead after 6 (9) months. Although level III dependants in nursing home care have a longer life expectancy in comparison to level III dependants in home care,<sup>15</sup> this effect reverses in the subsequent period. At the end of the observation period of 109 months, 93.2 (93.9) percent of the male (female) home care recipients, being first classified as level III dependant, are stated to be *dead*. In comparison to that 93.7 (95.6) percent of the male (female) level III LTCDs in nursing home care sector are defined to be *dead* after the same period of time.

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<sup>12</sup> More precisely, 2,059 persons in need of LTC will be excluded from the analysis and the underlying subsample shrinks to 112,344 persons.

<sup>13</sup> According to the German Federal Ministry of Health (2008) the fraction of persons in need of LTC in the age group 40+ amounts to 91 percent of all LTCDs. Thus, LTC for the elderly clearly makes up most of LTC.

<sup>14</sup> Within the age group 60 to 70 years the ratio of nursing home to home care is 0.26 (0.22), rises to 0.31 (0.44) in the age group 70 to 80 years and rises further to 0.49 (0.78) in the age group 80 to 90 years for male (female) LTCDs.

<sup>15</sup> This is due to higher mortality rates within home care during the first 6 months of LTC.

## 4.2 Model Statistics

Since 12 (14) percent of all male (female) LTCDs are still alive at the end of the observation period, assumptions have to be made concerning the ongoing LTC process after the observation period of 109 months. In a first step, annual transition probabilities between different care levels of home and nursing home care as well as the *healthy* and *dead* status are calculated for the entire observation period. The results of the annual transition probabilities for the observation period are given in tab. 4.<sup>16</sup> According to this outcome, the retention of the status quo, i.e. resting in one and the same dependency level and resting in one and the same type of care, is the most probable for any LTCD. For instance, the probability of staying one more year in care level I of home care is 74.0 (73.0) percent for male (female) LTCDs. The probability of staying one more year in care level II of nursing home care is 55.6 (57.3) percent, and the probability for a nursing home care level III dependant of dying one year later is 43.3 (41.2) percent for male (female) LTC beneficiaries. The results shown in tab. 4 further exemplify that the possibility of a care level downgrade can more or less be neglected, whereas an upgrade to a higher care level occurs rather frequently.<sup>17</sup>

**Tab. 4: Annual transition probabilities between different care levels**

**(a) male**

Transition probability								
	h.c. I	h.c. II	h.c. III	n.h.c. I	n.h.c. II	n.h.c. III	healthy	dead
h.c. I	0.7402	0.0836	0.0049	0.0196	0.0100	0.0029	0.0090	0.1299
h.c. II	0.0075	0.6608	0.0392	0.0001	0.0339	0.0060	0.0053	0.2471
h.c. III	0.0011	0.0051	0.5797	0.0000	0.0003	0.0423	0.0080	0.3635
n.h.c. I	0.0117	0.0034	0.0004	0.6560	0.0835	0.0169	0.0123	0.2157
n.h.c. II	0.0008	0.0096	0.0014	0.0043	0.5555	0.0785	0.0024	0.3476
n.h.c. III	0.0002	0.0000	0.0051	0.0033	0.0051	0.5517	0.0019	0.4327
healthy	-	-	-	-	-	-	0.8806	0.1194

\* h.c. = home care; n.h.c. = nursing home care

**(b) female**

Transition probability								
	h.c. I	h.c. II	h.c. III	n.h.c. I	n.h.c. II	n.h.c. III	healthy	dead
h.c. I	0.7298	0.0811	0.0050	0.0392	0.0191	0.0035	0.0054	0.1169
h.c. II	0.0044	0.6591	0.0429	0.0007	0.0657	0.0084	0.0045	0.2143
h.c. III	0.0008	0.0045	0.5842	0.0003	0.0005	0.0373	0.0033	0.3692
n.h.c. I	0.0078	0.0015	0.0002	0.5976	0.1395	0.0206	0.0020	0.2308
n.h.c. II	0.0004	0.0039	0.0008	0.0048	0.5732	0.0968	0.0013	0.3188
n.h.c. III	0.0001	0.0004	0.0029	0.0014	0.0046	0.5773	0.0008	0.4124
healthy	-	-	-	-	-	-	0.8957	0.1043

\* h.c. = home care; n.h.c. = nursing home care

Source: Own calculations based on data from AOK Berlin.

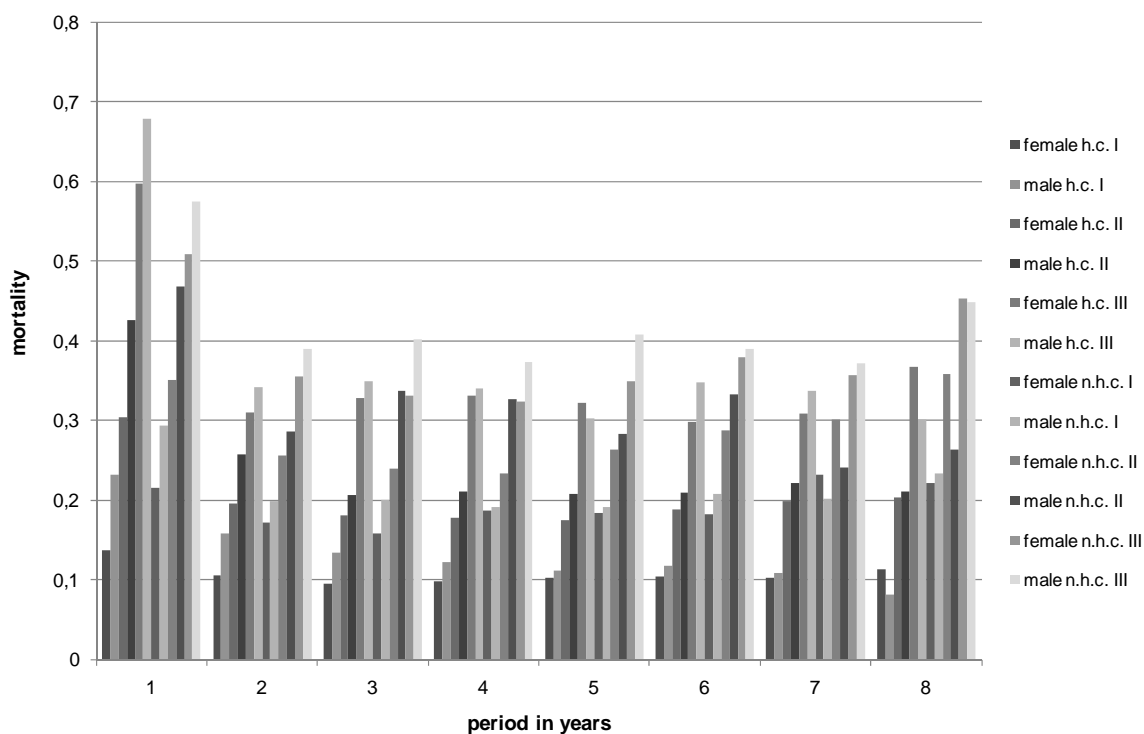
<sup>16</sup> For better illustration, tab. 4 depicts yearly instead of monthly results.

<sup>17</sup> When being classified as *healthy*, the sample only depicts the two cases of either staying *healthy* or being *dead* in the next period.

Having observed the transition probabilities within the observation period the next step is to analyse these probabilities over time in order to set a trend for the timeframe after the observation period of 109 months. For that reason, we look at the structure of the care level specific mortality rates, as they serve to derive the respective trend.

The highest mortality rates generally occur within the first year after entering the LTC dependent status; see fig. 3. LTCDs in level III of home care exhibit the absolute peak value, i.e. a mortality rate of 67.8 (60.0) percent for male (female) LTCDs. As of the second year in LTC, mortality rates of male (female) LTCDs drop significantly (to approximately 60 (69) percent of first years values) and remain on this lower level for the remaining observation period. Hence, for the remaining but unobservable timeframe we assume constant mortality rates.

**Fig. 3: Mortality rates of different care levels over time**

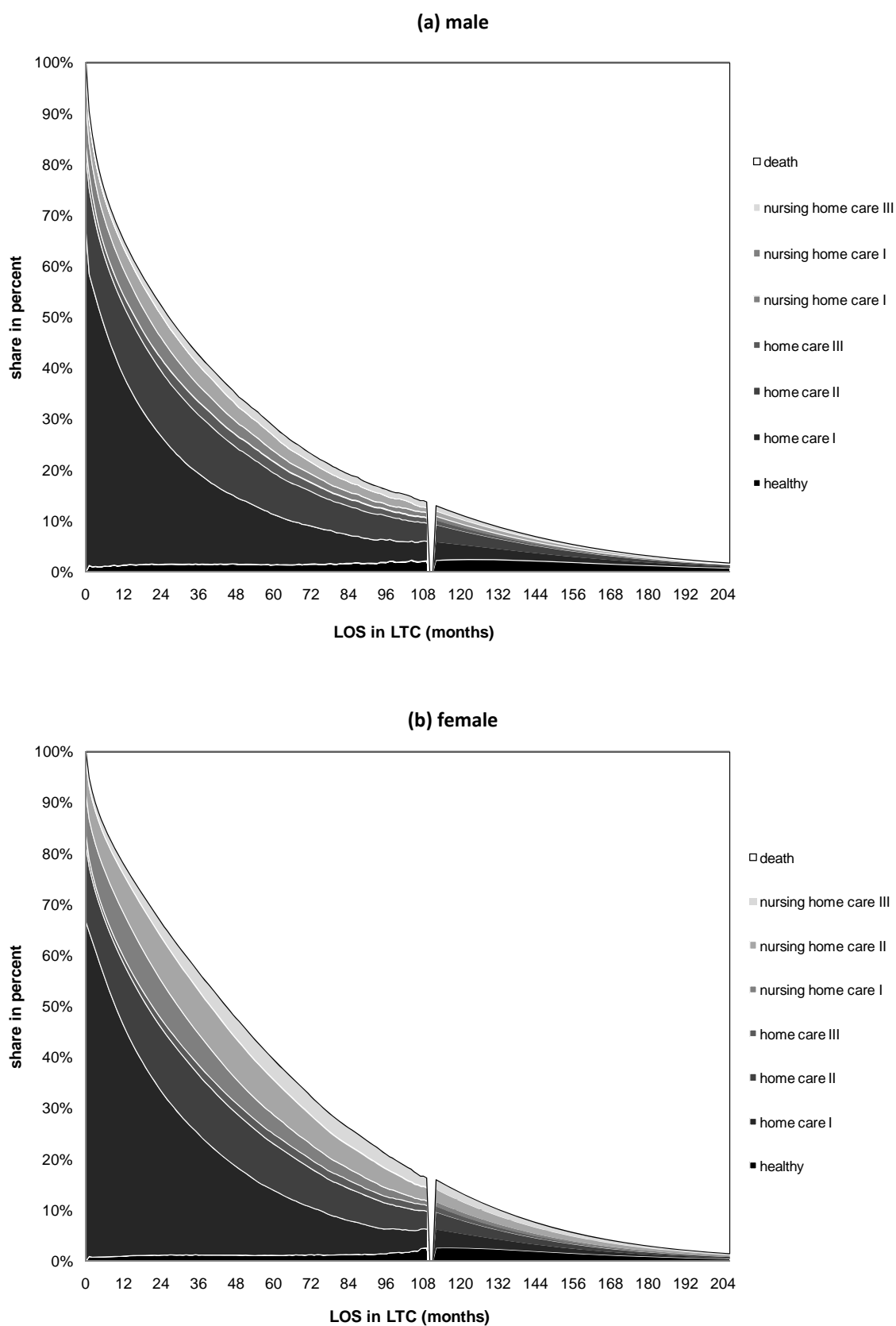


*Source: Own calculations based on data from AOK Berlin.*

Considering constant mortality rates the period of relevance increases to 500 months (41.7 years) — a point in time where eventually only 0.003 percent of the sample population is still alive. For calculating the average length of stay (ALOS) in LTC we neglect the remaining 0.003 percent of LTCDs thus limiting the new period of “observation” to 500 months. Fig. 4 displays the transitions between different states of LTC for this period.<sup>18</sup>

<sup>18</sup> For illustrative purpose the period of “observation” is limited to 204 months (17 years) — a point in time where only one percent of the sample population is still alive.

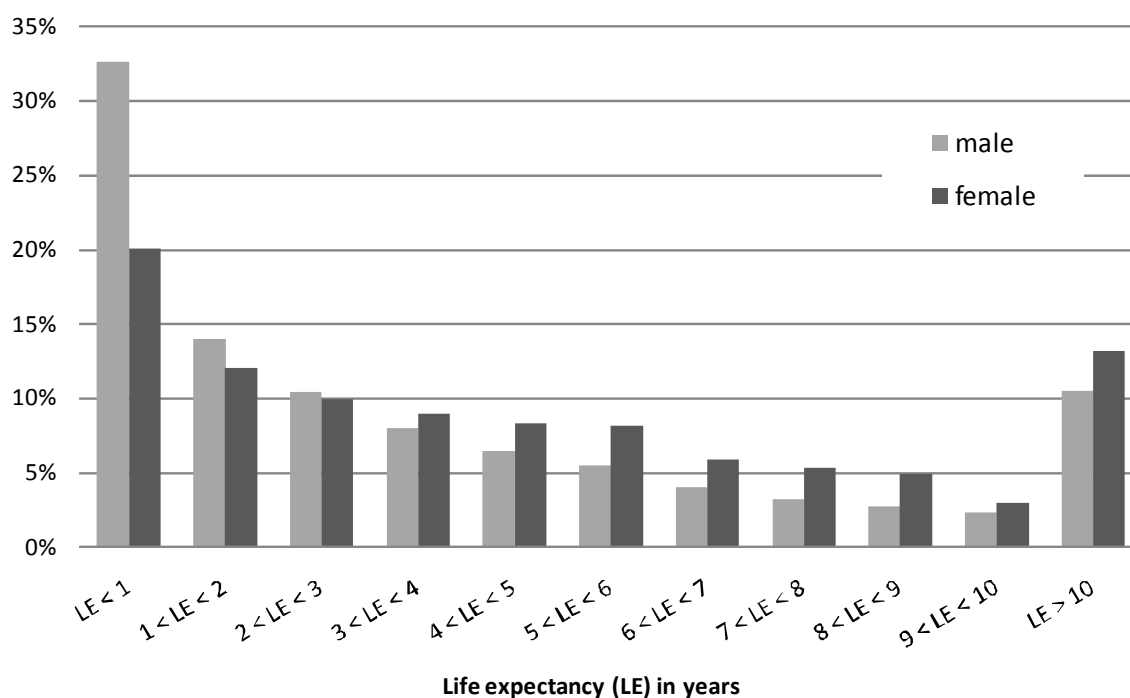
**Fig. 4: Gender-specific transitions between different states of LTC**



Source: Own calculations based on data from AOK Berlin.

The following paragraphs document the variance of the LOS as well as the ALOS. The variance in remaining life expectancy, or rather LOS in LTC, can be estimated employing a Monte-Carlo Simulation. According to this simulation 33 (20) percent of all male (female) LTCDs are defined to be dead after one year. Nevertheless, approximately 11 (13) percent of all male (female) beneficiaries are in need of LTC for ten years and more, see fig. 5.

**Fig. 5: Distribution of the LOS in LTC using Monte-Carlo-Simulation**



Source: Own calculations based on data from AOK Berlin.

The ALOS of a male LTCD (of the age group 40 years and older) comes to 48.4 months (also see tab. 5). Within this ALOS in LTC, the LTC recipient will spend 77.1 percent (37.2 months) of this time in home care, more precisely 21.3 months in level I, 13.1 months in level II and 2.8 months in level III). The remaining 22.9 percent (11.1 months) of the ALOS the LTC recipient will spend in nursing home care hereof 4 months in level I, 4.7 months in level II and 2.4 months in level III.<sup>19</sup> A female LTCD has an ALOS in LTC of 60.3 months. She will, on average, spend 67.2 percent (40.5 months) in home care (25.6 months in level I, 12.2 months in level II and 2.7 months in level III) and

<sup>19</sup> For those readers who are interested, we want to give a brief overview of the costs related to LTC. Considering an ALOS in LTC of 48.4 months entails a present value of overall cost of 91,192 Euro. As LTCl in Germany is designed as partial coverage insurance, 41,054 Euro (present value) are covered by LTCl and 50,140 Euro (present value) are out-of-pocket payments. This corresponds to a funding gap of 55.0 percent of overall LTC costs. This calculation is based on a real market interest rate of 3 percent p.a. and a real growth rate of 1.5 percent p.a.

32,8 percent (19.8 months) of her ALOS in nursing home care (6.4 months in level I, 8.8 months in level II and 4.6 months in level III).<sup>20</sup>

**Tab. 5: Average length of stay in LTC (ALOS)**

		male	female
Length of stay in months (share in percent)	total	48.4 (100.0%)	60.3 (100.0%)
	home care I	21.3 (44.0%)	25.6 (42.5%)
	home care II	13.1 (27.2%)	12.2 (20.2%)
	home care III	2.8 (5.9%)	2.7 (4.5%)
	nursing home care I	4.0 (8.3%)	6.4 (10.6%)
	nursing home care II	4.7 (9.7%)	8.8 (14.6%)
	nursing home care III	2.4 (5.0%)	4.6 (7.6%)

Source: Own calculations based on data from AOK Berlin.

Having given a comprehensive overview of the LOS in LTC we now turn to the question how proximity to death, age, and longevity affect the LOS in LTC and – due to its closeness – the per capita expenditures<sup>21</sup> thus trying to track down, whether the theory of compression or expansion of morbidity is true.

## 5 Compression or expansion of morbidity?

Concerning the effects of a longer life expectancy on the prevalence of LTC, three directions of effect are conceivable, i.e. prevalence stays unaltered, increases or shrinks. In this respect, the following hypotheses can be stated: first, the *status quo hypothesis* assuming that the age-specific risk of illness, or in this context the prevalence of LTC, remains constant even if people live longer. Secondly, the *morbidity hypothesis* basing on the assumption that the state of health aggravates in the course of a longer life expectancy as new possibilities of treating specific types of illness are life-prolonging, yet without completely curing the patient.<sup>22</sup> Rather than being perfectly restored, the prolonged life in illness will lead to further diseases causing a process of multi-morbidity. Thirdly, basing on the “compression of morbidity”-effect, the *time-to-death hypothesis*.<sup>23</sup> According to this hypothesis,

<sup>20</sup> The cost situation for female LTCs is similar. Considering an ALOS in LTC of 60.3 months entails a present value of overall cost of 116,368 Euro. Approximately 52,717 Euro (present value) are covered by LTCI and 63,650 Euro (present value) are out-of-pocket payments. This corresponds to a funding gap of 54.7 percent of overall LTC costs. Again, this calculation is based on a real market interest rate of 3 percent p.a. and a real growth rate of 1.5 percent p.a.

<sup>21</sup> As already mentioned, LTC history, i.e. the LOS in LTC accounting for different extents of care needed, respectively different disability levels, in the German LTCI system is closely related to per capita costs. Thus one-to-one statements from LOS on per capita LTC expenditures can be made.

<sup>22</sup> For further information concerning the morbidity hypothesis see Verbrugge (1984).

<sup>23</sup> The “compression of morbidity”-effect was first elaborated by Fries (1980).



medical progress and/or a healthier lifestyle lead to the observed increase in average life expectancy, evoking age-specific prevalence rates to decrease. Therefore, observed differences in age-specific prevalence rates of LTC cannot be explained by calendar age, but are caused by differences in the proximity to death. Using a large Swiss data set from 1999 to 2004 with per capita health care expenditures, Werblow et al. (2007) conclude that most components of health care expenditures cannot be explained by age but by proximity to death. According to them, the only exception to be made in this respect concerns users of LTC. Thus, while confirming the time-to-death hypothesis for users of health care services in general, Werblow et al. (2007) reject this hypothesis for users of LTC services where ageing matters, regardless of proximity to death.

Taking our data on the LOS in LTC we want to counter-check the general validity of the results of Werblow et al. (2007) in the following. The challenge in doing so is to model the impacts of age and proximity to death besides other specific personal data on the respective care level. As McKelvey and Zavoina (1975) demonstrate, linear regression models are problematic when the dependent variables are ordinal responses. In this case the usual assumptions for regression analysis are generally not met, which often causes the regression technique to fail in modeling the true, nonlinear relationship in the data. For mathematical simplicity, this study uses an ordered logit model with the health status of LTC recipients expressed in one of the three care levels I–III as dependent variable.<sup>24</sup>

The regression results are shown in tab. 6. Note that as the average LTC recipient is defined to be a LTCD in between care level I and II the sign changes from care level I to care level II and III when calculating the marginal effects of the probability on being level I, II or III dependent. This is due to the fact that care level I (II and III) is connected to a better (worse) health status than the average LTC recipient exhibits.

Given that the data set contains monthly data on the individual level, the variables AGE and TIME TO DEATH (TTD) are also defined on a monthly basis. In accordance with Werblow et al. (2007) the variable AGE has a significant positive and increasing effect on the probability of being in a higher care level.<sup>25</sup> According to this result, the time-to-death-hypothesis can be neglected for LTC recipients. Proximity to death shows the expected negative impact on the health status (indicated by the negative coefficient of TTD). In other words, the longer the time to death, the lower the care level. And as the elderly approach death, their use of LTC changes, not because they become older, but because their health deteriorates irreversibly.

Due to the fact that 41 percent of all LTC recipients of the data set are censored at the end of the observation period, the dummy variable DEATH distinguishes between censored and deceased persons (DEATH equals 1 if deceased). This dummy variable shows a positive and increasing effect in the care level (for the deceased persons). The dummy variable GENDER (with female equals 1) has a negative coefficient meaning that male LTCDs tend to switch to higher care levels earlier, thus having a shorter LOS in care level I, while female LTCD exhibit a prolonged LOS in care level I. As expected, the dummy variable NURSING HOME CARE (DUM N.H.C) shows the positive correlation between nursing home care and the care level.

Finally, the variable ASSESSMENT LEVEL is indicative of a (fundamental) change in the initial assignment to a specific care level. The negative sign points to the fact that over the observation period LTC recipients have increasingly been classified as level I dependants when first assessed. This

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<sup>24</sup> For further explanations of the ordered logit model see Cameron and Trivedi (2009).

<sup>25</sup> All explanatory variables are significant at the 99 percent confidence interval.

result proposes an improved health status of LTCDs over time, thus supporting the time-to-death hypothesis in the sense of a compression of morbidity.

Taken together, we obviously have two contradictory results, i.e. controlling for AGE the results reject the time-to-death hypothesis and controlling for ASSESSMENT LEVEL the results support the time-to-death-hypothesis for LTC recipients. In order to get a grip to these conflictive findings we examine the mortality rates of LTCDs more closely, hereby trying to filter whether the shift between the care levels is due to an improved health status or if this trend can be seen in a politically initiated change in favour of a stricter assessment policy for new entrants in LTC. Due to the tight financial situation of the LTCI and for cost saving reasons the MDK might be constrained to a stricter assessment policy on the part of the LTCI funds.

**Tab. 6: Transition probability in different care levels (ordered logit model)**

		Full model	Marginal effects		
Variable			level I	level II	level III
GENDER		-0.29587	0.07111	-0.05263	-0.01848
		(0.00265)	(0.00064)	(0.00047)	(0.00017)
ASSESSMENT LEVEL		-0.00956	0.00230	-0.00170	-0.00060
		(0.00062)	(0.00002)	(0.00001)	(0.00000)
DUM N.H.C.		1.12202	-0.27221	0.18229	0.08991
		(0.02578)	(0.00060)	(0.18229)	0.00028
DEATH		0.32983	-0.07920	0.05845	0.02075
		(0.00284)	(0.00068)	(0.00050)	(0.00018)
AGE		0.00769	-0.00185	0.00137	0.00048
		(0.00038)	(0.00009)	(0.00007)	(0.00002)
AGE2/100		0.00212	-0.00051	0.00038	0.00013
		(0.00015)	(0.00004)	(0.00003)	(0.00013)
TTD		-0.02631	0.00633	-0.00468	-0.00164
		(0.00016)	(0.00004)	(0.00003)	(0.00001)
TTD2/100		0.01733	-0.00417	0.00308	0.00108
		(0.00019)	(0.00005)	0.00003	(0.00001)
<i>All explanatory variables are significant at the 99% confidence interval</i>					

Source: Own calculations based on data from AOK Berlin.

In order to gain insight to the question whether LTCDs are faced with a better health status and/or with politically induced changes in the assessment policy of the MDK over time, the ongoing analysis focuses on mortality rates of LTCDs as an improved health status should lead to a decreasing mortality. In the following, we analyze the monthly mortality rate of LTCDs in every care level controlling for the regressors GENDER, DUM N.H.C., AGE, LENGTH OF STAY, and DUM 1st YEAR. As the dependent variable is described by the binary outcome DEAD and ALIVE, a logit model is used to describe the ongoing process.

The coefficients of the variables GENDER, DUM N.H.C. and AGE display that being male, cared for in a nursing home and old-age are the risk factors that raise mortality and subsequently reduce the LOS in LTC. In addition to that, the regressors DUM 1st YEAR and LENGTH OF STAY indicate the high risk of dying within the first year of LTC dependency as well as a decreasing mortality the longer a person in need of care rests in LTC.

**Tab. 7: Mortality of LTCDs (logit model)**

		Full model	Marginal effects
Variable			
	CONSTANT	-5.16514 (0.03734)	
	GENDER	-0.47299 (0.00898)	-0.00748 (0.00014)
	ASSESSMENT LEVEL I	-0.00274 (0.00020)	0.00004 (0.00000)
	ASSESSMENT LEVEL II	0.00677 (0.00033)	0.00011 (0.00001)
	ASSESSMENT LEVEL III	0.01041 (0.00051)	0.00016 (0.00001)
	DUM LEVEL II	0.31860 (0.01671)	0.00556 (0.00032)
	DUM LEVEL III	0.94582 (0.02742)	0.02374 (0.00102)
	DUM N.H.C.	0.24826 (0.01096)	0.00430 (0.00021)
	AGE	0.01860 (0.00040)	0.00029 (0.00001)
	LENGTH OF STAY	-0.01538 (0.00045)	-0.00024 (0.00001)
	DUM 1st YEAR	0.49778 (0.01158)	0.00869 (0.00022)
<i>All explanatory variables are significant at the 99% confidence interval.</i>			

*Source: Own calculations based on data from AOK Berlin.*

The results of the regression further indicate an increasing mortality rate the higher the care level a LTCD is first assessed to (see DUM LEVEL II and DUM LEVEL III).<sup>26</sup> Controlling for care level specific mortality rates over time, mortality decreases in level I (ASSESSMENT LEVEL I) and increases in level II and III (ASSESSMENT LEVEL II and III). As mortality for the population as a whole generally

<sup>26</sup> Looking at the marginal effects, we can see that mortality in care level II (III) is 0.5 percent (2.4 percent) higher than in level I.

decreases, Hackmann and Moog (2009) argue in support of a decline in mortality also of LTCDs.<sup>27</sup> This result of Hackmann and Moog (2009), however, can only be confirmed for level I, as our regression result shows the opposite effect for level II and level III LTCDs.

One possible explanation for this divergence can be seen in the afore-mentioned politically intended changes in the assessment policy of the MDK: given the same health status, LTC recipients having been assessed to level III in the past are now assessed to level II. Due to this change in assessment policy, the average health status has worsened in level II and level III, as recipients at the margin to level III are now being assessed to level II and recipients at the margin to level II are now being assessed to level I. Thus, the overall decreasing mortality trend regarding persons in need of LTC can only be verified for care level I. Obviously, this decreasing trend dominates the reverse effect of increasing mortality initiated by former level II LTCDs now being classified as level I LTCDs. This result, however, does not apply for care level II and III. Here, the overall time trend of decreasing mortality is dominated by the reverse effect of a changed assessment policy. Again, the fact that different effects dominate becomes obvious when looking at the distribution of the LTCDs on the three care levels: 53.7 percent of all LTCDs can be assigned to level I, 33.7 percent to level II and 12.5 percent to level III. As the majority of all LTCDs belong to care level I, the consequences of a change in assessment policy only have a relatively small impact on overall mortality in care level I, while the impact of a change in assessment policy is relatively big in level II and III featuring a highly significant effect. This phenomenon suggests that the observed fundamental change in the initial assessment to a care level can be explained both by improved health status and a change in assessment policy by the MDK.

## **6 Summary and conclusion**

The results of this paper on the LOS in LTC reveal a right-skewed distribution of life expectancy in LTC. The majority, i.e. 33 (20) percent of all male (female) LTCDs spend up to one year in LTC. Nevertheless, 11 (13) per cent spend ten years or more as beneficiaries of LTCI.

In line with the analysis of Werblow et al. (2007) the ordered logit analysis of this paper confirms the fact that LTC expenditures — resulting from the care levels respectively — are not only driven by proximity to death but also by age. Thus, the time-to-death hypothesis, stating that the prolonged life expectancy leads to a shift of LTC dependency to higher ages, is irrelevant for the rise in costs of LTC in the near future and must be rejected in case of LTC.

The analysis further revealed a shift in the first assessment to the different care levels. Focusing on the mortality rate of LTCDs, the results indicate improved health status in care level I and exactly opposite effects for care level II and III, namely a poorer health status. This outcome is certainly not straightforward, nevertheless, one possible explanation for this issue can be found in a political induced change in the classification of LTCDs in order to tighten expenditures of LTCI. If this presumption is correct, the increased mortality in care level II and III would be induced by political meddling rather than by changes in the health status — whereas the overall health status for LTC beneficiaries is assumed to have improved.

Concerning the question of the correct hypothesis regarding the effects of a longer life expectancy on age-specific prevalence rates and thus on the LOS in LTC, we at long last want to refer

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<sup>27</sup> For further information concerning this assumption see Hackmann and Moog (2009).

to Hackmann and Moog (2009) who underline the impact of mortality and incidence of new entrants into LTC. In other words, the validity of either the time-to-death hypothesis or the morbidity hypothesis can only be confirmed when the interaction of both mortality and incidence rates are taken into account. Abstracting from politically induced changes in the classification scheme of LTCDs the results of our analysis indicate a decrease in mortality rates. Concerning incidence rates, the existing literature reveals a decline as an overall trend (Hackmann and Moog (2009)). Altogether, two reverse effects emerge from a better health status: First, decreasing mortality rates lead to an increase in the prevalence of LTC, which argues for the morbidity hypothesis. Second, declining incidence rates entail a decrease in the prevalence of LTC and thus a shift in the disability level. A decrease in the prevalence of LTC, however, argues for the time-to-death hypothesis – regardless whether induced by political impact or by an improved health status of LTCDs. We leave it to future research to specify the dominating effect, i.e. whether the decrease in mortality or the decrease in incidence prevails.

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Forschungszentrum Generationenverträge

Albert-Ludwigs-Universität Freiburg

Bertoldstraße 17

79098 Freiburg

Fon 0761 . 203 23 54

Fax 0761 . 203 22 90

[www.generationenvertraege.de](http://www.generationenvertraege.de)

[info@generationenvertraege.de](mailto:info@generationenvertraege.de)