



# 4

## Rates of Care Poverty

Almost every study on unmet long-term care needs has examined their prevalence. However, datasets differ. Some are local, some national, some have tens of thousands of respondents while some have only a few dozen. Some data are purposefully collected for the study of unmet needs, while others are general population surveys. Measurements of unmet needs differ, as well. But practically all of these studies report the number or share of respondents whose care needs are not met.

In order to understand the importance of a social issue, it is always necessary to know its scale. This has also been the starting point for research into unmet care needs. Many studies go on to analyse the factors and consequences of unmet needs, but reporting their prevalence or, in the language of this book, the rate of care poverty is almost always the first research task. The term of *care poverty rate* follows, once again, the example of poverty research. For instance, the OECD (2021) defines the poverty rate as the ratio of people in a given age group whose income falls below the poverty line. Here, care poverty rate means the ratio of people, in a given group of people with care needs, whose care needs are not met.

So how widespread is care poverty? What part of the older population does not receive the support they need? How do care poverty rates differ across countries? These questions are straightforward but answering them is not, as different studies report a quite dissimilar prevalence of unmet needs even when examining the same nation. These studies tend to recall each other: typically, they involve survey questionnaires and examine the coverage of ADL- and IADL-based needs for older people. At the same time, there is variation in how they define and measure unmet care needs. This has made it difficult to compare and summarise their findings.

It is here where the framework outlined in Chap. 3 comes into use. Distinguishing between different domains of care needs and only comparing the results that focus on the same domain can be expected to improve the accumulation of knowledge. In the same way, it is also essential to note which measurement is used and to distinguish between absolute and relative approaches. Furthermore, it is also necessary to note which studies are based on proxy-respondent data as self-reporting and proxy-reporting seem to produce dissimilar results.

This chapter aims to report the available rates of care poverty in different countries based on existing studies of unmet needs. However, this summary should be seen as preliminary because it does not include all studies that examine the unmet care needs of older people—mostly due to language barriers and the availability of these publications. Several studies of unmet needs have also been deliberately left out for various reasons (such as if their samples concentrate on children or adults below the age of 65, or if they focus only on lack of formal care and exclude informal care from their analyses). Nonetheless, the objective here is to review such a number of studies that some initial conclusions can be drawn about the state of the art concerning care poverty rates in different parts of the world. This chapter begins with personal care poverty rates and continues with rates of practical care poverty. But before concluding with socio-emotional care poverty rates, the chapter needs to take a detour because there are a number of studies that do not make a distinction between personal and practical care needs.

## Rates of Personal Care Poverty

Out of the three domains of care needs and care poverty, the domain of personal care is most often studied. It could be argued that this domain is also the most basic: it includes vital everyday needs and ignoring them leads to serious problems for the health and well-being of older people. Personal care activities, such as feeding, can even be critical for survival.

Here, the findings on absolute care poverty are reported first, followed then by a review of results on relative care poverty. The overwhelming majority of the studies on personal care poverty are based on self-reporting, as proxy-based studies have proven to be rare and, in the case of absolute care poverty, practically non-existent. In several cases, the original figures for unmet needs reported in publications have been counted in a way different from that of the care poverty rate. For example, the level of unmet needs may be counted for the whole sample rather than only among those who have care needs. For each of these studies, I have recounted the care poverty rate based on figures provided in the publication. Furthermore, some studies report only activity-specific rates for individual ADLs or IADLs rather than the general level of all unmet needs. In these cases, the highest reported activity-specific level is used as an estimate for the general care poverty rate. In the tables, results are reported country by country in chronological order.

### Rates of Absolute Personal Care Poverty

The term of unmet needs has been used most widely in long-term care research in the United States. There, the absolute approach has been in active use since the late 1980s. Well-known early studies by Manton (1989) and Tennstedt et al. (1994) nevertheless produced quite different figures for the level of unmet needs: 9% vs. 35% (Table 4.1). The difference between these figures is at least partly explained by the longitudinal setting for the study by Tennstedt et al. While Manton's research was cross-sectional, Tennstedt et al. gathered baseline data among community-dwelling older people in 1984–1985. However, their results included only those who had survived and still lived in the community during a

**Table 4.1** Rates of absolute personal care poverty

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (% rounded)
US	Manton (1989)	65+	3499	1984	35
US	Tennstedt et al. (1994)	70+	235	1984	9 <sup>a</sup>
US	Sands et al. (2006)	70+	2943	1992–1997	18
US	Davey et al. (2013)	65+	2422	2004	41
US	Freedman and Spillman (2014)	65+	8077	2011	27/48 <sup>a,b</sup>
Spain	Tomás Aznar et al. (2002)	75+	351	1998	22
Canada	Carrière (2006)	65+	28,672	2003	42 <sup>c</sup>
UK	Vlachantoni et al. (2011)	65+	3356	2001–2002	52 <sup>a,c,d</sup>
		65+	4916	2008	50 <sup>a,c,e</sup>
UK	Whalley (2012)	65+	4231	2011–2012	76 <sup>a,c</sup>
UK	Maplethorpe et al. (2015)	65+	2067	2014	87 <sup>a</sup>
UK	Dunatchik et al. (2016)	65+	2090	2012–2013	70 <sup>c</sup>
UK	Marcheselli and Ridout (2019)	65+	2253	2018	87 <sup>a</sup>
UK	Vlachantoni (2019)	65+	5591	2014–2015	55
Malaysia	Momtaz et al. (2012)	60+	400	2003–2005	14 <sup>c</sup>
NZ	Wilkinson-Meyers et al. (2014)	75+ <sup>f</sup>	3753	2008–2009	7
China	Zhu and Österle (2017)	45+ <sup>g</sup>	3682	2013	31 <sup>a</sup>

<sup>a</sup>Recounted based on information provided in publication

<sup>b</sup>Depending on whether or not the category of ‘has some limitations but does not experience difficulty or receive help’ is interpreted as having care needs

<sup>c</sup>As the publication reports only activity-specific rates, the table shows the highest activity-specific level of unmet needs (for Dunatchik et al., 2016, the figure is based on levels reported in the Appendix, Table A2)

<sup>d</sup>Based on GHS dataset

<sup>e</sup>Based on ELSA dataset

<sup>f</sup>65+ for Māori participants

<sup>g</sup>The publication reports results only for the whole sample, but the majority (54%) of the sample was aged 65+

follow-up in 1988–1989. The age groups and the sample sizes for the two studies were also different. More recent studies display mostly results that are closer to those of Manton (1989), though these are not without exception (18% in Sands et al., 2006).

Within the literature reviewed here, the second country to use the absolute approach for examining the prevalence of unmet needs was Spain. However, Tomás Aznar et al. (2002) used it in an unusual way: if older people answered that they received support for their ADLs ‘never’ or ‘less than weekly’, they were categorised as having unmet needs; 22% of respondents with ADL-based support needs gave either of these two responses. In Canada, based on a national health survey, Carrière (2006) reported that 42% of older people with ADL needs did not receive any support.

The absolute approach has also been applied in several studies in the United Kingdom. Vlachantoni et al. (2011) used two general population surveys (English Longitudinal Study of Ageing [ELSA] and General Household Survey [GHS]) to find that at least half of the older population with care needs was left without any help (50% and 52%). Using more recent ELSA data, Vlachantoni (2019) acquired a rather similar result (55%). However, a study by Dunatchik et al. (2016) shows a higher figure (70%). Recounts of other studies that have used HSE (Health Survey on England) data also show very high absolute personal care poverty rates for Britain (76% in Whalley, 2012; 87% in Maplethorpe et al., 2015; 87% in Marcheselli & Ridout, 2019).

Finally, studies made by Momtaz et al. (2012), Wilkinson-Meyers et al. (2014) and Zhu and Österle (2017) demonstrate the recent spread of unmet need research to Asia and Oceania. New Zealand has a very low rate of absolute personal care poverty (7%), and Malaysia has a rather low figure (14%) as well, while the rate for China is higher (31%).

## Rates of Relative Personal Care Poverty

Next, we move from absolute personal care poverty to the insufficiency of available support for personal care needs—that is, relative personal care poverty (Table 4.2). A couple of studies that use proxy respondents are also included.

An early study by Allen and Mor (1997) as well as research by Komisar et al. (2005) showed high relative care poverty rates (40% and 58%). However, other American researchers ended up with considerably lower figures ranging from 17% (Kennedy, 2001) to 27% (DePalma et al., 2013). There were some dissimilarities in the questions used by different studies. For example, Desai et al. (2001) asked about needs at the present time, while Allen and Mor (1997) queried about the situation for the preceding month. The high figure reported in Komisar et al. (2005) is probably at least partly explained by that they studied 'dual eligibles', that is low-income older people who are eligible for both Medicare and Medicaid programmes. 'Dual eligibles' have poorer health and more extensive care needs than other American people in old age. In his study, Kennedy (2001) introduced a differentiation between 'unmet needs' (no support) and 'undermet needs' (insufficient support). This distinction has later become used by several researchers. It is also consistent with the double concept of absolute vs. relative care poverty.

For Spain, the two studies report somewhat different levels of unmet needs (29% vs. 40%). The first is a local study from Madrid carried out in the early 1990s (Otero et al., 2003), while the second is a large and more recent national-level survey (Rogero-García & Ahmed-Mohamed, 2014).

The new millennium has seen Chinese researchers actively entering the field of unmet needs research. Their results are very similar to one another, showing a very high relative personal care poverty rate ranging between 55% (Peng et al., 2015) and 61% (Zhen et al., 2015). However, the unanimity of their findings is not surprising as all these studies used the same CLHLS (Chinese Longitudinal Healthy Longevity Survey) dataset that originally focused on centenarians and only gradually extended to younger cohorts of people aged 65+.

In Canada, Dubuc et al. (2011) asked health professionals to define the needs of older persons and state whether these needs were met or not. This study belongs to a small body of research that uses proxy respondents to examine the unmet care needs of older people. The researchers themselves were surprised by the resulting high figure (47%), which they attributed to the use of these professional proxy assessments and a purposive sample that included only older people 'at risk of functional decline'.

**Table 4.2** Rates of relative personal care poverty

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (self-reported, %, rounded)	Care poverty rate (proxy-reported, %, rounded)
US	Allen and Mor (1997)	65+	632	1993–1994	40 <sup>a,b</sup>	
US	Desai et al. (2001)	70+	9447	1995	21	
US	Kennedy (2001)	65+	499	1995–1996	18 <sup>b</sup>	
		75+	317	1995–1996	17	
US	Komisar et al. (2005)	67+	2123	1999	58	
US	Newcomer et al. (2005)	18+ <sup>c</sup>	3493	1994–1997	20 <sup>b</sup>	
US	Li (2006)	65+	275	1999	25	
US	DePalma et al. (2013)	65+	844	1994–2004	27	
US	He et al. (2015)	65+	6730	1994–2004	21	
Spain	Otero et al. (2003)	65+	1135	1993	40	
Spain	Rogero-García and Ahmed-Mohamed (2014)	65+	3390	2008	29 <sup>b</sup>	
		80+	1668	2008	29	
China	Gu and Vlosky (2008)	65+	15,593	2005	60	
China	Peng et al. (2015)	80+	10,289	2005	61 <sup>b</sup>	
		80+	11,720	2008	55 <sup>b</sup>	
China	Zhen et al. (2015)	65+	3089	2005	61	
China	Zhu (2015)	80+	2938	2005	59 <sup>b</sup>	
		80+	2919	2008	55 <sup>b</sup>	
		80+	1647	2011	56 <sup>b</sup>	
Canada	Dubuc et al. (2011)	75+	433	2005		47
Taiwan	Liu et al. (2012)	65+	6820	2002	21 <sup>a</sup>	
NZ	Wilkinson-Meyers et al. (2014)	75+ <sup>d</sup>	3753	2008–2009	12	

(continued)

Table 4.2 (continued)

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (self-reported, %, rounded)	Care poverty rate (proxy-reported, %, rounded)
UK	Brimblecombe et al. (2017)	0+ <sup>c</sup>	150	2012–2013	55	73
Finland	Kröger et al. (2019)	75+	2910	2010–2015	17	

<sup>a</sup>As the publication reports only activity-specific rates, the table shows the highest activity-specific level of unmet needs

<sup>b</sup>Recounted based on information provided in publication

<sup>c</sup>Publication reports results only for the whole sample, but the majority of the sample was aged 65+ (53% in Newcomer et al., 2005, 60% in Brimblecombe et al., 2017)

<sup>d</sup>65+ for Māori participants

In Taiwan, Liu et al. (2012) analysed the database of the Long-Term Care Need Assessment system. This meant that respondents were all applying for a long-term care service. The observed care poverty rate (21%) is an underestimation for two reasons: the study did not include older people without a family caregiver and used a very strict definition of need (requiring several activity limitations). Meanwhile, a study from New Zealand shows only a low rate of relative personal care poverty (12% in Wilkinson-Meyers et al., 2014).

In Britain, Brimblecombe et al. (2017) made a unique study using a sample that included 150 carer/care receiver dyads who were asked whether the older/disabled person has the right amount of support or services. The answers of care receivers were compared to those of their informal carers. The findings showed that carers estimated the level of unmet needs distinctively higher (73%) than older and disabled people did (55%). Lastly, our study from Finland used survey data from two cities to observe a rather low care poverty rate among people aged 75+ with ADL-based needs (17% in Kröger et al., 2019).



## Activity-Specific Rates of Personal Care Poverty

Some of the above-mentioned studies report not only the general level of unmet needs but also activity-specific results on individual ADLs (Table 4.3). Comparison of exact activity-specific figures across studies is not justified due to differences in their methodological details and general levels of care poverty. Instead, it is worthwhile to look at whether the order of ADLs is similar across studies and whether some daily activities seem more prone to care poverty than others. Not all studies used exactly the same list of ADLs, which complicates the comparison. Some daily activities reported in only a couple of studies have also been excluded from the table.

No single daily activity received the highest rates in all studies, but activities related to moving seem to be problematic most often. Walking through a room (called ‘moving inside’ in some studies) has the highest level of unmet needs in five studies. Getting out of bed (or transferring) receives the same result. Four studies found using the stairs the most difficult task, even though only five studies include this activity in their ADL list. Two studies found toileting the most problematic activity, as with bathing and dressing. One study reports grooming as having the highest activity-specific personal care poverty rate.

At the same time, it is easy to identify the ADL activity with the lowest extent of care poverty: eating. No study reports eating to be most difficult, while as many as 13 studies list it to having the lowest level of unmet needs. Dressing comes next, ranked least problematic by three studies.

All in all, moving (including using the stairs and getting out of bed) clearly seems to have the highest level of unmet needs most often. Conversely, the ADL with the lowest level of care poverty is eating. Other activities are placed in between.

### Summary: Personal Care Poverty Rates

Comparing the findings on absolute vs. relative personal care poverty rates of the countries remains rather difficult. The data collection methods of individual studies on absolute personal care poverty still differ in

Table 4.3 Activity-specific personal care poverty rates

Country	Study	Bathing/ Showering	Dressing	Toileting	Transferring/ Getting out of bed	Eating	Grooming	Moving/ Walking through a room	Using the stairs
<i>Absolute personal care poverty</i>									
US	Manton (1989)	9	2	28	2	1		2	
UK	Vlachantoni et al. (2011) <sup>a,b</sup>	44	50						
UK	Vlachantoni et al. (2011) <sup>a,c</sup>	46	52		52				
UK	Whalley (2012) <sup>a</sup>	47	43	60	48	30		57	76
UK	Dunatchik et al. (2016)	50	56	66	67	38		70	86
UK	Vlachantoni (2019) <sup>a</sup>	54	58	71	63	53		73	
India	Ashokkumar et al. (2012) <sup>a</sup>		59	35	67	59		36	
Malaysia	Momtaz et al. (2012)	8	7		9	5	9	5	14
<i>Relative personal care poverty</i>									
US	Allen and Mor (1997) <sup>a</sup>	36	37	37	40	31		34	
US	Desai et al. (2001)	17	13	18	20	10		19	
US	Kennedy (2001) <sup>a,b</sup>	16	14	19	18	18		21	
US	LaPlante et al. (2004) <sup>d</sup>	36	28	15	26	10		32	

US	Komisar et al. (2005)	46	46	41	47	39	52
US	Newcomer et al. (2005) <sup>a,e</sup>	15	14	17	18	12	19
US	Li (2006)	16	7	6	7	2	6
US	Schure et al. (2015) <sup>f</sup>	39	68	21	29	48	24
Spain	Otero et al. (2003)	28	28	22	32	15	34
Canada	Dubuc et al. (2011)	25	3	3	3	6	6
Taiwan	Liu et al. (2012)	11	10	9		6	21
Finland	Kröger et al. (2019)	14	12	16	16	14	13

<sup>a</sup>Recounted from unweighted figures provided in the publication

<sup>b</sup>Based on ELSA dataset

<sup>c</sup>Based on GHS dataset

<sup>d</sup>The majority of respondents of this study may be younger than 65

<sup>e</sup>Unmet needs among the whole 18+ sample as specific results for older people are not available

<sup>f</sup>The study analysed unmet needs among Native Americans using a sample aged 55+ (instead of 65+) at the request of tribal stakeholders and because life expectancy is shorter for this group than for other ethnic groups in the United States

several ways, and the same goes for research on relative care poverty. Furthermore, unmet needs have not been examined using both approaches in every country. For research on New Zealand and Finland, we have only studies that apply the relative approach; for Malaysia, the sole study applies the absolute approach. Only a couple of proxy-based studies on personal care poverty were located, one from Canada and the other from the United Kingdom.

Relative care poverty figures can generally be expected to be higher than absolute figures. This is because relative figures include not only those who are not receiving any support despite their care needs, but also those who are receiving at least some informal or formal care—and find it inadequate. Spanish findings go well together with this principle as the reported rate of absolute care poverty (22%) is lower than relative care poverty rates (29–40%). In Canada, the relative figure is only slightly higher (42% vs. 47%), and even this difference is probably due to the use of proxy respondents. The results from Britain go against the expectation as reported levels of absolute personal care poverty are already very high (50–87%). The only available self-reported relative figure (55%) does not go beyond them. Neither does the proxy-reported relative figure (73%).

Findings from the United States are split into two parts. On the one hand, Manton's (1989) absolute care poverty rate (35%) fits well with Allen and Mor's (1997) and Komisar et al.'s (2005) rather high relative rates (40% and 58%). On the other hand, other relative rates are considerably lower (17–27%) as are the absolute rates reported by Tennstedt et al. (1994: 9%) and Sands et al. (2006: 18%). The second group of studies thus provides an alternative and considerably less negative depiction of the level of personal care poverty in the United States.

From China, several studies display very high levels (55–61%) of relative personal care poverty. However, the rate recounted from the only located study using the absolute approach is clearly lower (31% in Zhu & Österle, 2017). The absolute rate from Malaysia is very modest (14%), taking into account the scarcity of formal care provisions in the country. Relative rates reported from New Zealand (12%) and Finland (17%) are also low.

Putting nations into a rank order based on these studies remains complicated and needs to be done only with reservations as the studies use

different kinds of methods and datasets. In general, it can nevertheless be said that Britain shows extremely high levels of personal care poverty (50–87%) and that the Chinese rates (31–61%) are high, as well. The two reviewed studies on personal care poverty from Canada report slightly lower but still high figures (42–47%). For the United States, there is a huge spread in the results (9–58%). Spain displays medium-level results (22–40%), while single studies from Taiwan (21%), Finland (17%), Malaysia (14%), and New Zealand (12%) show lower rates of personal care poverty. However, major caution needs to be taken when drawing conclusions about national levels of personal care poverty, especially in cases where only one or two studies are available from a country.

## Rates of Practical Care Poverty

The second domain widely included in studies on unmet needs is practical daily activities that are most often measured through the IADL framework. The exact list of these activities varies somewhat between different studies but cleaning, cooking, taking medications, managing finances, transportation, and shopping are typically included. Difficulties in performing these activities usually occur considerably earlier than limitations in performing ADLs. This means that among the older population, IADL-based needs for practical care are much more common than ADL-based needs for personal care. Unlike ADL limitations, difficulties in performing IADLs rarely pose an immediate threat to the life or health of older people. But as IADLs are also essential to daily life, their limitations create a need for informal or formal support. If such support is not available to older persons or if the available support is inadequate, practical care poverty emerges, and this will, at least in the long run, bring about problems in well-being and health.

Unmet practical care needs have most often been studied in the same way as unmet personal care needs, using survey questionnaires where older people or proxy respondents report on needs as well as the receipt and adequacy of informal and formal support. However, not all studies distinguish IADLs from ADLs in their analysis, which makes it impossible to report separate rates of personal care poverty and practical care

poverty. Furthermore, as rather few researchers have examined only unmet practical care needs, there are not many studies available for review here.

## Rates of Absolute Practical Care Poverty

All studies reviewed in this section were already included in the list of studies analysing absolute personal care poverty. No studies examining only absolute practical care poverty were thus located. From the United States, two rather recent studies report a somewhat higher prevalence of unmet practical care needs (28% in Davey et al., 2013; 24%/33% in Freedman & Spillman, 2014) than Tennstedt et al. (1994), who reported 11% and 15% (Table 4.4). But by far, the highest rate of absolute practical care poverty in North America comes from Canada (67% in Carrière,

**Table 4.4** Rates of absolute practical care poverty

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (% rounded)
US	Tennstedt et al. (1994)	70+	235	1984	11 <sup>a</sup>
		74+	235	1988	15 <sup>a</sup>
US	Davey et al. (2013)	65+	2422	2004	28
US	Freedman and Spillman (2014)	65+	8077	2011	24/33 <sup>a,b</sup>
Canada	Carrière (2006)	65+	28,672	2003	67 <sup>c</sup>
UK	Vlachantoni et al. (2011)	65+	4916	2008	16 <sup>a,c</sup>
UK	Whalley (2012)	65+	4231	2011–2012	27 <sup>a,c</sup>
UK	Maplethorpe et al. (2015)	65+	2067	2014	54 <sup>a</sup>
UK	Marcheselli and Ridout (2019)	65+	2253	2018	51 <sup>a</sup>
UK	Vlachantoni (2019)	65+	5591	2016	24
Malaysia	Momtaz et al. (2012)	60+	400	2003–2005	12 <sup>c</sup>

<sup>a</sup>Recounted based on information provided in the publication

<sup>b</sup>Depending on whether the category of ‘has some limitations but does not experience difficulty or receive help’ is interpreted as having care needs or not

<sup>c</sup>As only activity-specific rates are reported in the publication, the table shows the highest activity-specific level of unmet needs

2006). From the United Kingdom, three studies show a medium level of unmet needs (16%–27%). However, two others report high rates of 51% and 54% (Maplethorpe et al., 2015; Marcheselli & Ridout, 2019). Finally, a low rate of absolute practical care poverty is reported from Malaysia (12% in Momtaz et al., 2012).

## Rates of Relative Practical Care Poverty

The number of studies that use the relative approach to measure unmet practical care needs is even smaller than those using the absolute approach (Table 4.5). The three available publications from the United States display quite different care poverty rates, ranging from 18% to 45%. By

**Table 4.5** Rates of relative practical care poverty

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (self-reported, %, rounded)	Care poverty rate (proxy-reported, %, rounded)
US	Allen and Mor (1997)	65+	632	1993–1994	45 <sup>a,b</sup>	
US	Kennedy (2001)	18+ <sup>c</sup>	25,805	1995–1996	18	
US	Newcomer et al. (2005)	18+ <sup>c</sup>	3493	1994–1997	25 <sup>b</sup>	
Spain	Otero et al. (2003)	75+	1135	1993	12	
Canada	Dubuc et al. (2011)	75+	433	2005		12
Finland	Kröger et al. (2019)	75+	2910	2010–2015	26	

<sup>a</sup>As only activity-specific rates are reported in the publication, the table shows the highest activity-specific level of unmet needs

<sup>b</sup>Recounted based on information provided in the publication

<sup>c</sup>In the publication, results are reported only for the whole sample, but the majority of the sample was aged 65+ (53% of the sample in Newcomer et al., 2005, 51% of those with unmet needs in Kennedy, 2001)

coincidence, the only studies from Spain and Canada show an identical low level (12%), though the Canadian figure results from proxy responses. A considerably higher figure (26%) is reported from Finland.

## Activity-Specific Rates of Practical Care Poverty

Despite the lack of studies reporting general rates of practical care poverty, as many as 15 available studies have reported activity-specific levels of unmet IADL-based needs (Table 4.6). Here, activities that were included only in one or two of the publications have been excluded from the table. The list of included IADLs is longer than the earlier one of ADLs, but at the same time, the studies differ greatly in terms of which specific activities were included in their analysis.

Four studies report cleaning/housekeeping as having the highest level of unmet needs. According to three publications, walking outside has the highest care poverty rate. Another three identify heavy housework as the most challenging practical care task. Two studies report that small home repairs, transport, managing finances, and light housework are each the most problematic IADLs, while cooking is given the highest care poverty rate once. None of the publications show taking medicines, grocery shopping, or using the telephone as the most problematic instrumental activity in daily life.

Taking medications is clearly the least challenging IADL, as seven studies report its unmet needs to be the lowest. This is followed by managing finances (four studies) and shopping (three studies). Two studies identify cooking, and one study identifies cleaning as the least problematic practical care need. No publication reports small repairs, light housework, walking outside, or using the telephone to have the lowest level of care poverty.

Overall, cleaning/housekeeping is the most problematic IADL. Walking outside and heavy housework are also challenging practical tasks. At the other end, taking medications is without a doubt the practical care need that has the lowest level of unmet need. Managing finances and grocery shopping seem to be the next least problematic activities.



**Table 4.6** Activity-specific practical care poverty rates

Country	Study	Taking medication	Cooking	House keeping/ cleaning and laundering	Small repairs or refurbishments at home, gardening	Managing financial affairs	Grocery shopping	Transport/ Going to hobbies or activities or visiting other people	Light house work	Heavy house work	Walking outside	Using the tele phone
<i>Absolute practical care poverty</i>												
US	Tennstedt et al. (1994)	2	1	7			3	0.4				
UK	Vlachantoni et al. (2011) <sup>a</sup>				16		8					
UK	Whalley (2012) <sup>a</sup>	8		27		16	21				25	
UK	Dunatchik et al. (2016)	16			31		18				69	
Malaysia	Momtaz et al. (2012)	7	9	12		12	10					
NZ	Wilkinson-Meyers et al. (2014)		4			8	3	4	7	6		
<i>Relative practical care poverty</i>												
US	Allen and Mor (1997) <sup>a</sup>		27	45			28	36	45	36		
US	Kennedy (2001) <sup>a,b</sup>	8	13			8	10	12	18	17		10
US	Newcomer et al. (2005) <sup>a,b</sup>	7	16			7	12	14	17	16	19	8
US	Schure et al. (2015)	9	21			17	21	22	29	36	32	14

(continued)

**Table 4.6** (continued)

Country	Study	Taking medication	Cooking	House keeping/ Cleaning and laundering	Small repairs or refurbishments at home, gardening	Managing financial affairs	Grocery shopping	Transport/					
								Going to hobbies or activities	or visiting other people	Light house work	Heavy house work	Walking outside	Using the tele phone
Spain	Otero et al. (2003) <sup>a</sup>		10			9	7	10	7	5			
Canada	Carrière (2006)		39				51		48	67			
Canada	Dubuc et al. (2011)	6	5	2		1	0.3					11	3
Canada	Busque and Légaré (2012) <sup>a</sup>		7	12	18	3	6	5					
NZ	Wilkinson-Meyers et al. (2014)			3		3	8	12	13	21			
Finland	Kröger et al. (2019)	8	15	20	20	10	15	24					

<sup>a</sup>Recounted based on figures provided in the publication

<sup>b</sup>Unmet needs among the whole 18+ sample, as specific results for older people are not available

## Summary: Practical Care Poverty Rates

As the number of studies focused only on unmet IADL needs is very limited, findings on practical care poverty are rarer than those on personal care poverty. The largest stock of studies comes again from the United States, where absolute practical care poverty rates range between 11% and 33% and relative rates between 18% and 45%, which sounds logical. The five British studies show absolute care poverty rates between 16% and 54%, which is a very wide variation. The lone Spanish and Malaysian studies both report a low level of 12%, just like Dubuc et al. (2011) from Canada. However, Carrière (2006) paints a totally different picture of the Canadian situation by reporting an absolute rate as high as 67%. Our Finnish study shows a medium level (26%) of practical care poverty.

Here, comparing countries is even more difficult than in the case of personal care poverty. If Carrière's (2006) results are to be trusted, Canada has much higher practical care poverty than any of the other studied countries. The United States, the United Kingdom, and Finland all seem to have medium levels, while Spain and Malaysia display rather low levels of practical care poverty. However, the number of studies is so limited that firm conclusions should be avoided.

## Rates of Personal-Practical Care Poverty

As mentioned earlier, several publications do not report one rate for unmet ADL needs and another for unmet IADL needs. Instead, they mix these two domains together. Results from these studies are reviewed here under the term 'personal-practical care poverty'. In addition to publications that only record combined figures, some of the aforementioned studies that present specific results for personal and/or practical care poverty also provide combined personal-practical figures. They, too, are included in this detour before we go to socio-emotional care poverty rates.

## Rates of Absolute Personal-Practical Care Poverty

Now the list of included countries becomes extended though, as usual, the United States has the largest number of studies (Table 4.7). Lima and Allen (2001) provide the lowest American figure so far: based on their dataset, only 3% of respondents with personal or practical care needs are in absolute care poverty. Results from Gibson and Verma (2006) are rather close (8% and 11%), with those of two other studies somewhat higher (18% in Tennstedt et al., 1994, and 22% in Shea et al., 2003). However, three American studies show much higher levels of absolute care poverty (41% in Freedman & Spillman, 2014, and 53% in both Davey & Patsios, 1999, and Davey et al., 2013).

The two studies from the United Kingdom display rather similar high figures of absolute care poverty (44% in Davey & Patsios, 1999, 58% in Dunatchik et al., 2016). Furthermore, the two publications addressing the situation in Sweden show very close—and extremely low—results (1% in Shea et al., 2003, 5–6% in Davey et al., 2007).

Nigeria has practically no formal care provisions, but it shows only a medium level of care poverty (20%), as with Malaysia (18%). The two studies from China—another country with limited formal care services—display a somewhat higher figure (34%). The Spanish (25%) and Slovenian (32%) rates are at the same level, while France (51%) and Ireland (63%) display considerably higher rates of absolute care poverty. Besides Ireland, only India shows a care poverty rate that exceeds 60%. At the other end, New Zealand (4%) joins Sweden in reporting a very low figure.

## Rates of Relative Personal-Practical Care Poverty

The list of studies using the relative approach to analyse combined rates of unmet personal and practical care needs is shorter than the list of those using the absolute approach (Table 4.8). It also includes one study that used proxy respondents.

For the United States, relative care poverty rates are more consistent (21–34%) than the rates of absolute care poverty. Only the figures of an early study by the General Accounting Office (1986) and Schure et al.’s

**Table 4.7** Rates of absolute personal-practical care poverty

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (% rounded)
US	Tennstedt et al. (1994)	70+	235	1984	18
US	Davey and Patsios (1999)	70+	1847	1994	53
US	Lima and Allen (2001)	65+	4466	1995–1996	3 <sup>a</sup>
US	Shea et al. (2003)	75+	4583	1992	22
US	Gibson and Verma (2006)	60+	449	2002	11 <sup>a</sup>
		70+	203	2002	8 <sup>a</sup>
US	Davey et al. (2013)	65+	2422	2004	53
US	Freedman and Spillman (2014)	65+	7609	2011	41 <sup>a</sup>
UK	Davey and Patsios (1999)	70+	1203	1994	44
UK	Dunatchik et al. (2016)	65+	584	2013	58 <sup>b</sup>
Sweden	Shea et al. (2003)	75+	1378	1994	1
Sweden	Davey et al. (2007)	75+	1242	1994	5
		75+	1466	2004	6
Nigeria	Gureje et al. (2006)	65+	2152	2003–2004	20
France	Gannon and Davin (2010)	65+	1166	2006–2007	51
Ireland	Gannon and Davin (2010)	65+	458	2006–2007	63
India	Ashokkumar et al. (2012)	60+	305	2005–2006	62 <sup>a</sup>
Malaysia	Momtaz et al. (2012)	60+	400	2003–2005	18
NZ	Wilkinson-Meyers et al. (2014)	75+ <sup>c</sup>	3753	2008–2009	4
Spain	García-Gómez et al. (2015)	16+ <sup>d</sup>	21,267	2008	25
Slovenia	Hlebec et al. (2016)	65+	1458	2013	32 <sup>a</sup>
China	Zhu and Österle (2017)	45+ <sup>e</sup>	3682	2013	34 <sup>a</sup>
China	Hu and Wang (2019)	60+	1324	2013–2014	34

*(continued)*

**Table 4.7** (continued)

<sup>a</sup>Recounted based on information provided in the publication

<sup>b</sup>According to the 'wider definition' of unmet needs used in the publication, which is rather close to the absolute approach

<sup>c</sup>65+ for Māori participants

<sup>d</sup>In the publication, results are reported only for the whole 16+ sample, but the majority (60%) of the sample were aged 65+

<sup>e</sup>In the publication, results are reported only for the whole 45+ sample, but the majority (54%) of the sample were aged 65+

**Table 4.8** Rates of relative personal-practical care poverty

Country	Study	Age group	Sample size	Data from year(s)	Care poverty rate (self-reported, %, rounded)	Care poverty rate (proxy-reported, %, rounded)
US	GAO (1986)	65+	36,000	1982	41	
US	Lima and Allen (2001)	65+	4466	1995–1996	21 <sup>a</sup>	
US	Newcomer et al. (2005)	18+	3493	1994–1997	27 <sup>a,b</sup>	
US	Gibson and Verma (2006)	60+	449	2002	30	
		70+	203	2002	27	
US	Schure et al. (2015)	55+ <sup>c</sup>	505	2006–2008	34	
France	Davin et al. (2006)	60+	8727	1999	13	
Canada	Dubuc et al. (2011)	75+	434	2003–2004		67 <sup>d</sup>
Canada	Busque and Légaré (2012)	65+	4142	2002	18	
Spain	Rogero-García and Ahmed-Mohamed (2011)	60+	3718	2008	28 <sup>a</sup>	
		75+	2463	2008	28 <sup>a</sup>	
		85+	813	2008	26 <sup>a</sup>	
NZ	Wilkinson-Meyers et al. (2014)	75+ <sup>e</sup>	3753	2008–2009	30	
Finland	Kröger et al. (2019)	75+	2910	2010–2015	26	

<sup>a</sup>Recounted based on information provided in the publication

<sup>b</sup>In the publication, results are reported only for the whole 18+ sample, but the majority (53%) of the sample were aged 65+

<sup>c</sup>The sample consisted of Native Americans

<sup>d</sup>Besides ADLs and IADLs, this figure includes unmet needs for communication and mental functions

<sup>e</sup>65+ for Māori participants

(2015) research into rates among Native Americans go beyond 30%. The care poverty rate from France (13%) is the lowest of all countries. Busque and Légaré's (2012: 18%) result from Canada is low as well, but once again, another Canadian study shows a very high figure (67% in Dubuc et al., 2011). The reported relative personal-practical care poverty rates from Finland and Spain are almost identical (26–28%), and this time they are slightly lower than the figure for New Zealand (30%).

### Summary: Personal-Practical Care Poverty Rates

Looking at the results for personal-practical care poverty, the general view remains fragmented and somewhat illogical. Spain shows a logical pattern as its rate of absolute care poverty (25%) is lower than its rate of relative care poverty (29%). In New Zealand, the situation is the same with an even larger gap between the absolute and relative figures (4% and 30%). But France is an opposite case with its rate of absolute care poverty (51%) substantially higher than its relative figure (13%). The absolute French rate comes from the SHARE dataset, though, which regularly gives rather high levels of unmet needs for many countries (see Chap. 8).

Besides Spain, New Zealand, and France, the United States is the only other country from which both absolute and relative results are available. Lima and Allen (2001) as well as Gibson and Verma (2006) report both absolute (3–11%) and relative figures (21–30%). These are, as expected, well in line with each other. Furthermore, the absolute results of 18–22% from two other studies (Tennstedt et al., 1994; Shea et al., 2003) fit rather well together with the relative levels of 34–41% reported in two publications (GAO, 1986; Schure et al., 2015). However, the high absolute rate of 53% (in Davey & Patsios, 1999, and Davey et al., 2013) remains an outlier. The same could perhaps be said about Lima and Allen's (2001) aforementioned very low absolute rate (3%).

For other countries, only absolute or relative figures are available. The high Irish absolute figure (63%) and the Slovenian result (32%) also originate from SHARE data. Once again, Canada has one extremely high proxy-based rate (67%) and another substantially lower self-reported rate (18%). For Malaysia (18%) and Nigeria (20%), absolute levels are rather low—especially when taking into account that formal provisions in both

countries are very limited. China (34%) shows here a somewhat higher level of care poverty. Spain, Finland, and New Zealand all remain at a medium level (25%–30%).

Based on the reviewed studies, Sweden and New Zealand are probably the nations with the lowest levels of personal-practical care poverty (although the relative rate for New Zealand is not so low and no relative figure is available for Sweden). Malaysia and Nigeria also display rather low levels. Finland, Spain, Slovenia, and China seem to have medium levels of personal-practical care poverty. For the United States, there is once again wide variation in results. The position of France depends fully on which of the two reviewed studies is taken as the reference point, and the same goes for Canada. Britain displays high levels of unmet needs. There were only sole studies available for review from Ireland and India, which both show very high care poverty rates.

## Rates of Socio-emotional Care Poverty

Compared to personal and practical care needs, it is rare for studies of unmet needs to focus on socio-emotional needs. Literature concerning unmet emotional and social needs among people in old age is thus very limited (for exceptions, see McInnis-Perry et al., 2013; Someşan & Hărăguş, 2016). Even when the research addresses these needs, studies are usually focused on some specific subgroups of older people such as cancer patients, people with dementia, or people with HIV (Hansen et al., 2017; Ogletree et al., 2019; Williams et al., 2019). Even though social and emotional needs have become recognised as essential to the well-being of older people, there is a major knowledge gap concerning the unmet socio-emotional needs of people in old age.

At the same time, loneliness among older people has become a popular area of gerontological research (Yang, 2019). In recent decades, this research has extended from North America and Western Europe to Southern and Eastern Europe, Asia, and Africa (De Jong Gierveld et al., 2018). Loneliness studies have followed the same kind of trajectory of geographical expansion as studies on unmet needs, but their volume has



overshadowed the unmet need literature. Although both are practised within the discipline of gerontology and they gained popularity mostly simultaneously and in a similar vein, research on unmet needs and research on loneliness have rarely had close contact. De Jong Gierveld and Tesch-Römer (2012, p. 287) discuss loneliness as a result of unfulfilled social needs, calling this the ‘deficit approach’ to loneliness. Ten Bruggencate et al. (2018, p. 1746) also mention how when the social needs of older people go unsatisfied, this can lead to loneliness and social isolation. In general, however, it has been unusual to see these two research areas integrated or loneliness conceptualised as an unmet need.

As mentioned in Chap. 3, this volume understands older people’s loneliness as an expression of their unmet socio-emotional care needs. The concept of loneliness as a self-perceived discrepancy between desired and actual social interaction (De Jong Gierveld et al., 2018) fits well with the framework of care poverty, especially its relative measurement approach. Though the absence of loneliness does not guarantee that all of the socio-emotional needs of older people are being met, loneliness can nevertheless be understood as an indicator of care poverty—of relative socio-emotional care poverty, to be exact. This definition makes it possible to refer to loneliness literature in the study of care poverty, especially in a situation where other research on the unmet socio-emotional care needs of the older population is scarce.

## Rates of Relative Socio-emotional Care Poverty

There are hundreds of studies reporting on the prevalence of loneliness among older people in different countries. This means it is not possible to review all or even a major part of them here. However, a number of reviews of loneliness studies have been published in the past few decades (e.g., Wenger et al., 1996; Routasalo & Pitkälä, 2003). More recently, even reviews have tended to become specialised by not addressing all loneliness studies. They focus instead on only a certain aspect of this research, such as the relationship between loneliness and heart disease (e.g., Valtorta et al., 2016), or by reviewing the literature from only one country (e.g., Chen et al., 2014).

Loneliness studies are more established than unmet need studies, and there already are several international (particularly European) datasets providing harmonised data for comparative research into loneliness while reliable international data on unmet needs are still missing. The SHARE dataset has had a question on loneliness since its first wave (2004–2006), for instance, while it still has no question about unmet need; this dataset has served as a basis for comparative research into loneliness. Other international datasets with one or more questions on loneliness in their design include the European Social Survey (ESS) and the Generations and Gender Survey (GGS).

The loneliness question in SHARE asks, ‘How often have you experienced the feeling of loneliness over the last week?’ Possible answers include ‘almost all of the time’, ‘most of the time’, ‘some of the time’, and ‘almost none of the time’ (Sundström et al., 2009, p. 269). The first two answers are usually considered ‘frequent loneliness’. For the ESS, both the question and possible answers are almost identical (Yang & Victor, 2011, pp. 1375–1376). The GGS instead uses the De Jong Gierveld Loneliness Scale, which consists of six different questions and a resulting summary index (Hansen & Slagsvold, 2016).

Findings from five studies, which are based on the analysis of these three international survey datasets, are reviewed here. First, there are three comparative studies using the SHARE data. Sundström et al. (2009) analyse data from the first wave of SHARE, which was collected from 12 countries in 2004–2006. Their analysis uses subsample of people aged 65 years or older, including 14,012 respondents. Vozikaki et al. (2018) analyse data from the first wave as well, covering the same 65+ age group. However, their subsample includes only 5129 respondents and excludes Israel. Fokkema et al. (2012) examine data from the second wave, which was gathered from 14 countries in 2006–2007. Unlike the two previously mentioned studies, this study includes all respondents aged 50 years and over (12,248 in total). Next, Yang and Victor (2011) analyse data from the third round (2006–2007) of the ESS. They include all 47,099 respondents, aged 15–101, in their analysis but report separate national loneliness figures for the 60+ age group. Finally, Hansen and Slagsvold (2016) analyse GGS data collected over the period of 2004–2011, comprising 33,832 respondents aged 60–80 from 11

countries. As the researchers want to focus on a serious and problematic level of loneliness, they raise the loneliness cut-off point for the De Jong Gierveld Loneliness Scale index score from the commonly used 2 to 6.

Several mostly Northern or Western European countries (Austria, Belgium, Denmark, France, Germany, the Netherlands, Spain, Sweden, and Switzerland) are included in four or all five of these studies (Table 4.9). It is no surprise that the three SHARE studies offer rather similar results, but findings from studies of the ESS and GGS data are not very dissimilar, either. The ESS figures used by Yang and Victor (2011) seem slightly lower in some cases than those from the other four studies, but this is not systematic for all countries. Although the GGS results use a brand-new cut-off threshold, they are often very close to those of the other studies. Yet if we look at countries that are included in only two or three studies (Bulgaria, Czechia, Greece, Ireland, Italy, Norway, Poland, Romania, and Russia), gaps between the figures are often larger. For example, the difference between the three figures from Greece is 10 percentage points. Finally, there are several countries with a result from only one of the studies (Cyprus, Estonia, Finland, Georgia, Hungary, Israel, Latvia, Lithuania, Portugal, Slovakia, Slovenia, Ukraine, and the United Kingdom).

Based on these comparative loneliness studies, which countries have the highest relative socio-emotional care poverty? The highest figure comes from Georgia (38%), based on the GGS study, followed by Bulgaria (34%), Lithuania (28%), Romania (27%), Czechia (23%), and Russia (21%) (Hansen & Slagsvold, 2016). For their part, Yang and Victor (2011) show a very high loneliness figure for Ukraine (34%) and substantial levels also for Russia (24%) and Hungary (21%). Vozikaki et al. (2018) report high levels of loneliness for Italy (28%) and Greece (26%). All in all, countries that have at least one value over 20% include Bulgaria, Czechia, Georgia, Greece, Hungary, Italy, Lithuania, Romania, Russia, and Ukraine. All of these countries come either from Southern Europe or from (Central) Eastern Europe, which confirms the findings from earlier studies highlighting the spread of loneliness especially in these parts of Europe (e.g., Jylhä & Saarenheimo, 2010).

The middle category of countries, which display at least one result at the 11%–20% level of loneliness, is more varied in terms of geographical location. This group includes Austria, Belgium, Germany, Estonia,

**Table 4.9** Rates of socio-emotional care poverty (%)<sup>a</sup>

Country	Study				
	Sundström et al. (2009)	Fokkema et al. (2012)	Vozikaki et al. (2018)	Yang and Victor (2011)	Hansen and Slagsvold (2016)
Austria	10	11	12	11	
Belgium	13	13	12	9	11
Bulgaria				19	34
Cyprus				10	
Czechia		16			23
Denmark	6	6	6	3	
Estonia				14	
Finland				6	
France	15	18	13	11	11
Georgia					38
Germany	9	9	14	7	11
Greece	21	16	26		
Hungary				21	
Ireland		12		5	
Israel	15				
Italy	18	25	28		
Latvia				19	
Lithuania					28
Netherlands	9	8	11	6	
Norway				5	8
Poland		20		20	12
Portugal				15	
Romania				19	27
Russia				24	21
Slovakia				20	
Slovenia				15	
Spain	14	16	14	12	
Sweden	7	10	8	7	
Switzerland	4	8	5	5	
Ukraine				34	
UK				7	

<sup>a</sup>Based on comparative loneliness studies

France, Ireland, Israel, Latvia, the Netherlands, Poland, Portugal, Slovakia, Slovenia, and Spain. Here, almost all parts of Europe are represented: Western, Central, Eastern, and Southern Europe (plus the non-European country of Israel).

Finally, there is a smaller group of European countries where the loneliness level is reported to be 10% or below: Cyprus, Denmark, Finland, Norway, Sweden, Switzerland, and the United Kingdom. With the exceptions of Cyprus and Switzerland, these countries are all from Northern Europe. All four Nordic nations included in the reviewed studies were placed in this country group.

With the exception of Israel, only European countries are included in the above-mentioned datasets and studies. However, many loneliness studies have certainly been carried out for the non-European nations included in earlier sections of this chapter examining the prevalence of unmet personal and practical care needs (Table 4.10). From the United States, China, India, and New Zealand, there are reviews of loneliness literature available (Chen et al., 2014; Ong et al., 2016; Wright-St Clair et al., 2017; Hossain et al., 2020). For Taiwan, Malaysia, Nigeria, and Canada, only individual studies on the prevalence of loneliness among older people were located (Tsai et al., 2013; Teh et al., 2014; Menec et al., 2019; Igbokwe et al., 2020).

Here, this literature is used to provide results on the level of socio-emotional care poverty in these countries. Rates vary from 4–8% in Taiwan to 5–77% in India. In the other countries, the prevalence of loneliness among older people is reported between 8% and 29%. However, it is important to remember that the figures from non-European countries are not comparable to those from European ones as they were determined through the use of non-harmonised methods and measurements. For example, some of these publications do not make a distinction between infrequent and frequent loneliness.

## Rates of Absolute Socio-emotional Care Poverty

Here, loneliness studies have been used to gain knowledge of relative socio-emotional care poverty. But is there a way to operationalise loneliness research to determine absolute socio-emotional care poverty, as well? Absolute care poverty means a situation where, despite care needs, there is no informal or formal support available. In the case of socio-emotional care needs, it would mean that the person has no access to any emotional



NOR					5-8
POL					12-20
PRT					15
ROU					19-27
RUS					21-24
SVK					20
SVN				32	15
SWE				1-6	7-10
UKR					34
Asia					
CHN	31	55-61		34	9-25
IND				62	5-77
ISR					15
MYS	14		12	18	21
TWN					4-8
Oceania					
NZL	7	21		4	8-13
Africa					
NGA		12		20	22
				30	

<sup>a</sup>Based on loneliness studies

<sup>b</sup>Proxy-reported (the only or the higher figure)

or social support. This is the situation in full social isolation. When a person has zero social contacts, they are receiving zero social support. Accordingly, absolute socio-emotional care poverty could be operationalised to include those people who do not receive any emotional or social support from anyone—that is, who are in full social isolation. However, comparative international literature on the prevalence of social isolation among older people seems limited. Thus, no information on the rates of absolute socio-emotional care poverty can be provided here.

### **Summary: Socio-emotional Care Poverty Rates**

Here, loneliness is taken as an expression of unmet emotional and social needs—and thus of socio-emotional care poverty. Socio-emotional care poverty is a more multidimensional issue than loneliness: different groups of older people may need different kinds of support, which can range from professional psychosocial care to the satisfaction of intimacy needs. Research on these issues within the older population is still unable to yield a solid stream of literature. As a substitute, research into loneliness can be used to indicate the rates of socio-emotional care poverty among older people. Care poverty means the deprivation of basic human needs, which threatens the well-being and health of older people. That is why results indicating frequent loneliness are used here.

A summary of the findings from five comparative loneliness studies does not bring many surprises: in Europe, socio-emotional care poverty is most widespread in the eastern and southern parts of the continent, although there are positive exceptions (e.g., Portugal and Slovenia) in these regions. Western and Central European countries are mostly placed in the middle category, while loneliness levels seem to be lowest in the Nordic countries, Switzerland, the United Kingdom, and the Mediterranean exception Cyprus.

Concerning less harmonised studies from non-European countries, India displays very high (but at the same time varying) rates. The United States, China, Malaysia, and Nigeria show a rather high prevalence of socio-emotional care poverty among their older populations, while rates



for Canada and New Zealand are somewhat lower but still higher than those for Taiwan. Differences in the measurements used by these studies reduce their comparability.

## Conclusions

So in the end, how widespread is care poverty? Does it vary between countries? The answer to the second question is yes, it certainly varies. However, it is not possible to provide definitive national care poverty rates. Findings based on the absolute vs. the relative measurement approach obviously differ from each other, as do results from the three different domains (Table 4.10). Findings from different studies vary even within the same domain for the same nation. In some countries, such as Spain, several studies of the same domain show rather similar findings. But for other countries, the United States in particular, the results display large within-domain variations.

In general, it is the scarcity of research that poses the most substantial barrier to drawing conclusions about national levels of care poverty. The most salient feature of the summary table for existing studies is the overwhelming number of empty cells (Table 4.10). It is very probable that several studies on unmet needs have unintentionally dropped out of view, and as mentioned earlier, a number of unmet need studies were unusable here as a care poverty rate could not be calculated from their figures. Nonetheless, studies of unmet needs are still rare.

Despite the expansion of publications particularly in the 2010s, studies are still conducted in only a minority of nations. Within Europe, a majority of countries lack research on the unmet personal and practical care needs of their older populations. Furthermore, comparative analyses performed with reliable international data are conspicuous in their absence, with the notable exception of loneliness studies. While the breadth of loneliness research makes it possible to fill in the last column of the summary table for every included country, not even half of the cells can be completed for any other column—and only those countries where at least some research on unmet care needs is available were included in the table in the first place.

Caution is needed, but some observations can be made about the reviewed studies by looking at the results from different domains in each country. In Canada, personal and practical care poverty seem to be considerably more common than loneliness. As stated already, the United States has huge variation in almost every care poverty domain. Several (but not all) studies report high levels of personal as well as practical care poverty. Loneliness seems to be somewhat rarer, though still substantial.

In Spain, personal (and personal-practical) care poverty rates are higher than those for practical care poverty and especially for socio-emotional care poverty. In Finland, practical care poverty is clearly more typical than personal care poverty, while frequent loneliness is exceptional. Results from France are inconsistent. The United Kingdom shows a very low rate of loneliness, but very high rates of personal care poverty. Rates of practical care poverty are slightly lower yet remain high. Both Ireland and Slovenia have rather high levels of personal-practical care poverty, but much lower levels of socio-emotional care poverty. Of all included countries, Sweden has the lowest rates of personal-practical care poverty, and its loneliness level is low, too.

The relative levels of personal care poverty are very high in China, while absolute personal and personal-practical care poverty are both at a medium level. Indian care poverty rates are high, but available only for personal-practical and socio-emotional domains. Malaysia has low or medium levels of personal, practical, and personal-practical care poverty, while its rate for socio-emotional care poverty is higher. Taiwan is reported to have a very low level of loneliness, but a medium level of personal care poverty. New Zealand has mostly very low rates of care poverty. Finally, Nigeria has rather low levels of personal-practical and socio-emotional care poverty. Overall, the three domains appear to be rather independent from each other, as countries may have high care poverty rates in one domain, but not in another.

If we compare the rates of absolute vs. relative care poverty, the assumption was that relative rates would be considerably higher, as they include all who assess their care as inadequate. However, the results do not support such a clear logic. In Britain, the highest rates come from absolute personal care poverty. In Canada, they come from absolute practical care poverty (although relative personal-practical care poverty is equally high).

In Spain, relative rates are slightly higher than absolute rates. In China, there is a clear difference between the absolute and relative rates of personal care poverty. Despite the wide variation of results in the United States, the ranges of relative rates are somewhat higher than those of absolute rates. However, conclusions made here remain preliminary, as only very few countries have results from both measurement approaches and from the same care poverty domain.

## References

- Allen, S., & Mor, V. (1997). The prevalence and consequences of unmet need: Contrasts between older and younger adults with disability. *Medical Care*, 35(11), 1132–1148. <https://doi.org/10.1097/00005650-199711000-00005>
- Ashokkumar, T., Chacko, T. V., & Munuswamy, S. (2012). Physical disabilities among the rural elderly: Identifying surrogate markers of unmet disability care needs. *International Journal of Tropical Medicine*, 7(1), 38–41. <https://doi.org/10.3923/ijtmed.2012.38.41>
- Brimblecombe, N., Piccard, L., King, D., & Knapp, M. (2017). Perceptions of unmet needs for community social care services in England: A comparison of working carers and the people they care for. *Health and Social Care in the Community*, 25(2), 435–446. <https://doi.org/10.1111/hsc.12323>
- Busque, M.-A., & Légaré, J. (2012). Les besoins non comblés de services à domicile chez les aînés canadiens. *Canadian Journal on Ageing/La Revue canadienne du vieillissement*, 31(3), 271–283. <https://doi.org/10.1017/S0714980812000189>
- Carrière, G. (2006). Seniors' use of home care. *Health Reports*, 17(4), 43–47.
- Chen, Y., Hicks, A., & White, A. E. (2014). Loneliness and social support of older people in China: A systematic literature review. *Health and Social Care in the Community*, 22(2), 113–123. <https://doi.org/10.1111/hsc.12051>
- Davey, A., & Patsios, D. (1999). Formal and informal community care to older adults: Comparative analysis of the United States and Great Britain. *Journal of Family and Economic Issues*, 20(3), 271–299. <https://doi.org/10.1023/A:1022957426159>
- Davey, A., Savla, J., Zarit, S. H., Sundström, G., & Malmberg, B. (2007). How equitable is Sweden's changing care mix? Linking individual and regional characteristics over time. *Ageing and Society*, 27(4), 511–532. <https://doi.org/10.1017/S0144686X07005946>

- Davey, A., Takagi, E., Sundström, G., & Malmberg, B. (2013). (In)formal support and unmet needs in the national long-term care survey. *Journal of Comparative Family Studies*, 44(4), 437–453. <https://doi.org/10.3138/jcfs.44.4.437>
- Davin, B., Joutard, X., Moatti, J.-P., Paraponaris, A., & Verger, P. (2006). Besoins et insuffisance d'aide humaine aux personnes âgées à domicile: une approche à partir de l'enquête «Handicaps, incapacités, dépendance». *Sciences Sociales et Santé*, 24(3), 59–93. <https://doi.org/10.3406/sosan.2006.1689>
- De Jong Gierveld, J., & Tesch-Römer, C. (2012). Loneliness in old age in Eastern and Western European societies: Theoretical perspectives. *European Journal of Ageing*, 9(4), 285–295. <https://doi.org/10.1007/s10433-012-0248-2>
- De Jong Gierveld, J., van Tilburg, T. G., & Dykstra, P. A. (2018). New ways of theorizing and conducting research in the field of loneliness and social isolation. In A. Vangelisti & D. Perlman (Eds.), *The Cambridge handbook of personal relationships* (2nd ed., pp. 391–404). Cambridge University Press. <https://doi.org/10.1017/9781316417867.031>
- DePalma, G., Xu, H., Covinsky, K. E., Craig, B. A., Stallard, E., Thomas, J., 3rd, & Sands, L. P. (2013). Hospital readmission among older adults who return home with unmet need for ADL disability. *The Gerontologist*, 53(3), 454–461. <https://doi.org/10.1093/geront/gns103>
- Desai, M. M., Lentzner, H. R., & Weeks, J. D. (2001). Unmet need for personal assistance with activities of daily living among older adults. *The Gerontologist*, 41(1), 82–88. <https://doi.org/10.1093/geront/41.1.82>
- Dubuc, N., Dubois, M. F., Raïche, M., Gueye, N. R., & Hébert, R. (2011). Meeting the home-care needs of disabled older persons living in the community: Does integrated services delivery make a difference? *BMC Geriatrics*, 11(67). <https://doi.org/10.1186/1471-2318-11-67>
- Dunatchik, A., Icardi, R., Roberts, C., & Blake, M. (2016). *Predicting unmet social care needs and links with well-being: Findings from the secondary analysis*. Ipsos MORI.
- Fokkema, T., De Jong Gierveld, J., & Dykstra, P. A. (2012). Cross-national differences in older adult loneliness. *The Journal of Psychology*, 146(1–2), 201–228. <https://doi.org/10.1080/00223980.2011.631612>
- Freedman, V. A., & Spillman, B. C. (2014). Disability and care needs among older Americans. *The Milbank Quarterly*, 92(3), 509–541. <https://doi.org/10.1111/1468-0009.12076>
- Gannon, B., & Davin, B. (2010). Use of formal and informal care services among older people in Ireland and France. *The European Journal of Health Economics*, 11(5), 499–511. <https://doi.org/10.1007/s10198-010-0247-1>

- GAO. (1986). *Need to strengthen home health care payment controls and address unmet needs*. United States General Accounting Office.
- García-Gómez, P., Hernández-Quevedo, C., Jiménez-Rubio, D., & Oliva-Moreno, J. (2015). Inequity in long-term care use and unmet need: Two sides of the same coin. *Journal of Health Economics*, *39*, 147–158. <https://doi.org/10.1016/j.jhealeco.2014.11.004>
- Gibson, M. J., & Verma, S. K. (2006). *Just getting by: Unmet need for personal assistance services among persons 50 or older with disabilities*. AARP.
- Gu, D., & Vlosky, D. (2008). Long-term care needs and related issues in China. In J. B. Garner & T. C. Christiansen (Eds.), *Social sciences in health care and medicine* (pp. 52–84). Nova Science Publishers.
- Gureje, O., Ogunniyi, A., Kola, L., & Afolabi, E. (2006). Functional disability in elderly Nigerians: Results from the Ibadan Study of Aging. *Journal of the American Geriatrics Society*, *54*(11), 1784–1789. <https://doi.org/10.1111/j.1532-5415.2006.00944.x>
- Hansen, A., Hauge, S., & Bergland, Å. (2017). Meeting psychosocial needs for persons with dementia in home care services: A qualitative study of different perceptions and practices among health care providers. *BMC Geriatrics*, *17*, 211. <https://doi.org/10.1186/s12877-017-0612-3>
- Hansen, T., & Slagsvold, B. (2016). Late-life loneliness in 11 European countries: Results from the generations and gender survey. *Social Indicators Research*, *129*(1), 445–464. <https://doi.org/10.1007/s11205-015-1111-6>
- He, S., Craig, B. A., Xu, H., Covinsky, K. E., Stallard, E., Thomas, J., 3rd, Hass, Z., & Sands, L. P. (2015). Unmet need for ADL assistance is associated with mortality among older adults with mild disability. *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences*, *70*(9), 1128–1132. <https://doi.org/10.1093/gerona/glv028>
- Hlebec, V., Srakar, A., & Majcen, B. (2016). Determinants of unmet needs among Slovenian old population. *Zdravstveno Varstvo*, *55*(1), 78–85. <https://doi.org/10.1515/sjph-2016-0011>
- Hossain, M. M., Purohit, N., Khan, N., McKyer, E. L. J., Ma, P., Bhattacharya, S., & Pawar, P. (2020). Prevalence and correlates of loneliness in India: A systematic review. *Advance (preprint)*. <https://doi.org/10.31124/advance.11533026.v3>
- Hu, B., & Wang, J. (2019). Unmet long-term care needs and depression: The double disadvantage of community-dwelling older people in rural China. *Health and Social Care in the Community*, *27*(1), 126–138. <https://doi.org/10.1111/hsc.12630>

- Igbokwe, C. C., Ejeh, V. J., Agbaje, O. S., Umoke, P. I. C., Iweama, C. N., & Ozoemena, E. L. (2020). Prevalence of loneliness and association with depressive and anxiety symptoms among retirees in Northcentral Nigeria: A cross-sectional study. *BMC Geriatrics*, *20*, 153. <https://doi.org/10.1186/s12877-020-01561-4>
- Jylhä, M., & Saarenheimo, M. (2010). Loneliness and ageing: Comparative perspectives. In D. Dannefer & C. Phillipson (Eds.), *The sage handbook of social gerontology* (pp. 317–328). Sage. <https://doi.org/10.4135/9781446200933.n24>
- Kennedy, J. (2001). Unmet and undermet need for activities of daily living and instrumental activities of daily living assistance among adults with disabilities: Estimates from the 1994 and 1995 disability follow-back surveys. *Medical Care*, *39*(12), 1305–1312. <https://doi.org/10.1097/00005650-200112000-00006>
- Komisar, H. L., Feder, J., & Kasper, J. D. (2005). Unmet long-term care needs: An analysis of Medicare-Medicaid dual eligibles. *Inquiry*, *42*(2), 171–182. [https://doi.org/10.5034/inquiryjrnl\\_42.2.171](https://doi.org/10.5034/inquiryjrnl_42.2.171)
- Kröger, T., Mathew Puthenparambil, J., & Van Aerschot, L. (2019). Care poverty: Unmet care needs in a Nordic welfare state. *International Journal of Care and Caring*, *3*(4), 485–500. <https://doi.org/10.1332/239788219X15641291564296>
- LaPlante, M. P., Kaye, H. S., Kang, T., & Harrington, C. (2004). Unmet need for personal assistance services: Estimating the shortfall in hours of help and adverse consequences. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *59*(2), S98–S108. <https://doi.org/10.1093/geronb/59.2.S98>
- Li, H. (2006). Involvement of informal and formal service providers: Meeting the home care needs of older adults with severe functional impairments. *Home Health Care Services Quarterly*, *25*(3–4), 167–183. [https://doi.org/10.1300/J027v25n03\\_10](https://doi.org/10.1300/J027v25n03_10)
- Lima, J. C., & Allen, S. M. (2001). Targeting risk for unmet need: Not enough help versus no help at all. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *56*(5), S302–S310. <https://doi.org/10.1093/geronb/56.5.s302>
- Liu, Y.-H., Chang, H.-J., & Huang, C.-C. (2012). The unmet activities of daily living (ADL) needs of dependent elders and their related factors: An approach from both an individual- and area-level perspective. *International Journal of Gerontology*, *6*(3), 163–168. <https://doi.org/10.1016/j.ijge.2012.05.009>

- Manton, K. G. (1989). Epidemiological, demographic, and social correlates of disability among the elderly. *The Milbank Quarterly*, 67(S2), 13–58. <https://doi.org/10.2307/3350235>
- Maplethorpe, N., Darton, R., & Wittenberg, R. (2015). *Social care: Need for and receipt of help. HSE 2014: Vol 1*. Health and Social Care Information Centre. Retrieved August 22, 2021, from <http://healthsurvey.hscic.gov.uk/media/33548/HSE2014-Ch5-Social-care-need-and-receipt.pdf>
- Marcheselli, F., & Ridout, K. (2019). *Health survey for England 2018: Social care for older adults*. Health and Social Care Information Centre. Retrieved August 22, 2021, from <http://healthsurvey.hscic.gov.uk/media/81673/HSE18-Social-Care-rep.pdf>
- McInnis-Perry, G., Weeks, L. E., & Stryhn, H. (2013). Age and gender differences in emotional and informational social support insufficiency for older adults in Atlantic Canada. *Canadian Journal of Nursing Research*, 45(4), 50–68. <https://doi.org/10.1177/084456211304500405>
- Menec, V. H., Newall, N. E., Mackenzie, C. S., Shoostari, S., & Nowicki, S. (2019). Examining individual and geographic factors associated with social isolation and loneliness using Canadian Longitudinal Study on Aging (CLSA) data. *PloS One*, 14(2), e0211143. <https://doi.org/10.1371/journal.pone.0211143>
- Momtaz, Y. A., Hamid, T. A., & Ibrahim, R. (2012). Unmet needs among disabled elderly Malaysians. *Social Science & Medicine*, 75(5), 859–863. <https://doi.org/10.1016/j.socscimed.2012.03.047>
- Newcomer, R., Kang, T., LaPlante, M., & Kaye, S. (2005). Living quarters and unmet need for personal care assistance among adults with disabilities. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 60(4), S205–S213. <https://doi.org/10.1093/geronb/60.4.s205>
- OECD. (2021). *Poverty rate*. OECD. Retrieved August 23, 2021, from <https://data.oecd.org/inequality/poverty-rate.htm>
- Ogletree, A. M., Brennan-Ing, M., Blieszner, R., Karpiak, S. E., & Sands, L. P. (2019). Health burden, support adequacy, and depressive symptoms in older men with HIV. *The Gerontologist*, 59(6), 1131–1140. <https://doi.org/10.1093/geront/gny169>
- Ong, A. D., Uchino, B. N., & Wethington, E. (2016). Loneliness and health in older adults: A mini-review and synthesis. *Gerontology*, 62(4), 443–449. <https://doi.org/10.1159/000441651>
- Otero, A., de Yébenes, M. J., Rodríguez-Laso, A., & Zunzunegui, M. V. (2003). Unmet home care needs among community-dwelling elderly people in Spain. *Aging Clinical and Experimental Research*, 15(3), 234–242. <https://doi.org/10.1007/BF03324504>

- Peng, R., Wu, B., & Ling, L. (2015). Unmet needs for assistance in personal activities of daily living among community-dwelling oldest old in China from 2005 to 2008. *Research on Aging*, 37(2), 148–170. <https://doi.org/10.1177/0164027514524257>
- Rogero-García, J., & Ahmed-Mohamed, K. (2011). La satisfacción de las necesidades de las personas dependientes de 60 años y más según proveedor de cuidado. España, 2008. *Revista Española de Salud Pública*, 85(6), 541–553.
- Rogero-García, J., & Ahmed-Mohamed, K. (2014). What is the best care for community-dwelling dependent adults? Sources of care and perception of unmet needs in Spain. *Revista Internacional de Sociología*, 72(2), 403–427. <https://doi.org/10.3989/ris.2012.09.12>
- Routasalo, P., & Pitkälä, K. (2003). Loneliness among older people. *Reviews in Clinical Gerontology*, 13(4), 303–311. <https://doi.org/10.1017/S095925980400111X>
- Sands, L. P., Wang, Y., McCabe, G. P., Jennings, K., Eng, C., & Covinsky, K. E. (2006). Rates of acute care admissions for frail older people living with met versus unmet activity of daily living needs. *Journal of the American Geriatrics Society*, 54(2), 339–344. <https://doi.org/10.1111/j.1532-5415.2005.00590.x>
- Schure, M. B., Conte, K. P., & Goins, R. T. (2015). Unmet assistance need among older American Indians: The native elder care study. *The Gerontologist*, 55(6), 920–928. <https://doi.org/10.1093/geront/gnt211>
- Shea, D., Davey, A., Femia, E. E., Zarit, S. H., Sundström, G., Berg, S., & Smyer, M. A. (2003). Exploring assistance in Sweden and the United States. *The Gerontologist*, 43(5), 712–721. <https://doi.org/10.1093/geront/43.5.712>
- Someșan, V., & Hărăguș, M. (2016). Elderly needs and support received. *Romanian Journal of Population Studies*, 10(1), 105–132.
- Sundström, G., Fransson, E., Malmberg, B., & Davey, A. (2009). Loneliness among older Europeans. *European Journal of Ageing*, 6(4), 267–275. <https://doi.org/10.1007/s10433-009-0134-8>
- Teh, J. K. L., Tey, N. P., & Ng, S. T. (2014). Family support and loneliness among older persons in multiethnic Malaysia. *The Scientific World Journal*, 654382. <https://doi.org/10.1155/2014/654382>
- Ten Bruggencate, T., Luijckx, K. G., & Sturm, J. (2018). Social needs of older people: A systematic literature review. *Ageing & Society*, 38(9), 1745–1770. <https://doi.org/10.1017/S0144686X17000150>



- Tennstedt, S., McKinlay, J., & Kasten, L. (1994). Unmet need among disabled elders: A problem in access to community long term care? *Social Science & Medicine*, 38(7), 915–924. [https://doi.org/10.1016/0277-9536\(94\)90424-3](https://doi.org/10.1016/0277-9536(94)90424-3)
- Tomás Aznar, C., Moreno Aznar, L. A., Germán Bes, C., Alcalá Nalváiz, T., & Esteban, A. E. (2002). Dependencia y necesidades de cuidados no cubiertas de las personas mayores de una zona de salud de Zaragoza. *Revista Española de Salud Pública*, 76(3), 215–226.
- Tsai, F. J., Motamed, S., & Rougemont, A. (2013). The protective effect of taking care of grandchildren on elders' mental health? Associations between changing patterns of intergenerational exchanges and the reduction of elders' loneliness and depression between 1993 and 2007 in Taiwan. *BMC Public Health*, 13, 567. <https://doi.org/10.1186/1471-2458-13-567>
- Valtorta, N. K., Kanaan, M., Gilbody, S., Ronzi, S., & Hanratty, B. (2016). Loneliness and social isolation as risk factors for coronary heart disease and stroke: Systematic review and meta-analysis of longitudinal observational studies. *Heart*, 102(13), 1009–1016. <https://doi.org/10.1136/heartjnl-2015-308790>
- Vlachantoni, A. (2019). Unmet need for social care among older people. *Ageing & Society*, 39(4), 657–684. <https://doi.org/10.1017/S0144686X17001118>
- Vlachantoni, A., Shaw, R., Willis, R., Evandrou, M., Falkingham, J., & Luff, R. (2011). Measuring unmet need for social care amongst older people. *Population Trends*, 145, 56–72. <https://doi.org/10.1057/pt.2011.17>
- Vozikaki, M., Papadaki, A., Linardakis, M., & Philalithis, A. (2018). Loneliness among older European adults: Results from the survey of health, aging and retirement in Europe. *Journal of Public Health*, 26(6), 613–624. <https://doi.org/10.1007/s10389-018-0916-6>
- Wenger, G., Davies, R., Shahtahmasebi, S., & Scott, A. (1996). Social isolation and loneliness in old age: Review and model refinement. *Ageing & Society*, 16(3), 333–358. <https://doi.org/10.1017/S0144686X00003457>
- Whalley, R. (2012). *Social care: Need for and receipt of help*. HSE 2012: Vol 1. Health and Social Care Information Centre. Retrieved August 23, 2021, from [http://healthsurvey.hscic.gov.uk/media/1019/chpt-8\\_social-care-need-and-receipt.pdf](http://healthsurvey.hscic.gov.uk/media/1019/chpt-8_social-care-need-and-receipt.pdf)
- Wilkinson-Meyers, L., Brown, P., McLean, C., & Kerse, N. (2014). Met and unmet need for personal assistance among community-dwelling New Zealanders 75 years and over. *Health and Social Care in the Community*, 22(3), 3173–3127. <https://doi.org/10.1111/hsc.12087>

- Williams, G. R., Pisu, M., Rocque, G. B., Williams, C. P., Taylor, R. A., Kvale, E. A., Partridge, E. E., Bhatia, S., & Kenzik, K. M. (2019). Unmet social support needs among older adults with cancer. *Cancer*, *125*(3), 473–481. <https://doi.org/10.1002/cncr.31809>
- Wright-St Clair, V. A., Neville, S., Forsyth, V., White, L., & Napier, S. (2017). Integrative review of older adult loneliness and social isolation in Aotearoa/ New Zealand. *Australasian Journal on Ageing*, *36*(2), 114–123. <https://doi.org/10.1111/ajag.12379>
- Yang, K. (2019). *Loneliness: A social problem*. Routledge. <https://doi.org/10.4324/9781315148410>
- Yang, K., & Victor, C. (2011). Age and loneliness in 25 European nations. *Ageing and Society*, *31*(8), 1368–1388. <https://doi.org/10.1017/S0144686X1000139X>
- Zhen, Z., Feng, Q., & Gu, D. (2015). The impacts of unmet needs for long-term care on mortality among older adults in China. *Journal of Disability Policy Studies*, *25*(4), 243–251. <https://doi.org/10.1177/1044207313486521>
- Zhu, H. (2015). Unmet needs in long-term care and their associated factors among the oldest old in China. *BMC Geriatrics*, *15*, 46. <https://doi.org/10.1186/s12877-015-0045-9>
- Zhu, Y., & Österle, A. (2017). Rural-urban disparities in unmet long-term care needs in China: The role of the *hukou* status. *Social Science & Medicine*, *191*, 30–37. <https://doi.org/10.1016/j.socscimed.2017.08.025>

**Open Access** This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

