

# **Earlier Palliative Home Care is associated with Patient-Centered Medical Resource Utilization and lower costs in the last 30 days before death in COPD: a Population-level Decedent Cohort study**

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## Appendix 1 List of covariates for each medical resource use

Medical resource use	Demographic variables* and number of visits with a palliative character from a community nurse 365-30 days before death	Care given between 720 and 30 days before death								
		Mean length of stay ICU admission	Number of ICU admissions	Number of hospitalisations	Number of ER admissions	Number of GP contacts	Number of physiotherapist contacts	Number of specialist contacts	Number of Chest radiograph	Number of invasive ventilation
Hospital admission	X	X	X		X	X	X	X	X	X
Hospital days, mean	X	X	X		X	X	X	X	X	X
ICU admission	X			X	X	X	X	X	X	X
LOS ICU	X			X	X	X	X	X	X	X
Palliative care unit admission	X	X	X	X	X	X	X	X	X	X
LOS Palliative care unit	X	X	X	X	X	X	X	X	X	X
ODC	X	X	X	X	X	X	X	X	X	X
ER admission	X	X	X	X		X	X	X	X	X
Home care	X	X	X	X	X	X	X	X	X	X
GP contact	X	X	X	X	X		X	X	X	X
Number of GP contacts	X	X	X	X	X		X	X	X	X
Specialist contact	X	X	X	X	X	X	X		X	X
Number of specialist contacts	X	X	X	X	X	X	X		X	X
Physiotherapist contact	X	X	X	X	X	X		X	X	X
Number of physiotherapist	X	X	X	X	X	X		X	X	X
Invasive ventilation	X	X	X	X	X	X	X	X	X	
Non-invasive ventilation	X	X	X	X	X	X	X	X	X	X
Gastric tube	X	X	X	X	X	X	X	X	X	X
Urinary tract catheter	X	X	X	X	X	X	X	X	X	X
CPR	X	X	X	X	X	X	X	X	X	X
Medical imaging	X	X	X	X	X	X	X	X	X	X
Chest radiograph	X	X	X	X	X	X	X	X		X
Number Chest radiograph	X	X	X	X	X	X	X	X		X
Spirometry	X	X	X	X	X	X	X	X	X	X
Oxygen	X	X	X	X	X	X	X	X	X	X
Opioids	X	X	X	X	X	X	X	X	X	X
Sedatives	X	X	X	X	X	X	X	X	X	X
Morphine	X	X	X	X	X	X	X	X	X	X
COPD drugs	X	X	X	X	X	X	X	X	X	X
Hospital death	X	X	X	X	X	X	X	X	X	X
Home death	X	X	X	X	X	X	X	X	X	X
Death in nursing home	X	X	X	X	X	X	X	X	X	X

\*Age, gender, household type, attained educational level, income, comorbidities, year of death, urbanisation level of the municipality of residence.

Abbreviations: ICU: intensive care unit; LOS: length of stay (in days); ER: Emergency Room, GP: general practitioner; ODC: one-day-care; CPR: coronary pulmonary resuscitation

## Appendix 2 Characteristics of COPD patients (using palliative home care)

Characteristics	Total study population	No Palliative Home Care <sup>‡</sup>	Palliative Home Care <sup>‡</sup>	Palliative home care >30DBD
<b><i>n</i> (% of total study population, n= 58527)</b>	58527(100.0)	56776(97.0)	1751(3.0)	644 (1.1)
<b>Gender, n(%)<sup>*</sup></b>				
Male	35025(59.8)	33965(59.8)	1060(60.5)	385(59.8)
Female	23502(40.2)	22811(40.2)	691(39.5)	259(40.2)
<b>Age, n(%)<sup>*</sup></b>				
18-64y	5678(9.7)	5548(9.8)	130(7.4)	75(11.6)
65-74y	10177(17.4)	9897(17.4)	280(16.0)	127(19.7)
75-84y	21607(36.9)	20963(36.9)	644(36.8)	248(38.5)
85-94y	19210(32.8)	18581(32.7)	629(35.9)	179(27.8)
≥ 95y	1810(3.1)	1744(3.1)	66(3.8)	14(2.2)
<b>Educational level, n(%)<sup>*</sup></b>				
None	4430(7.6)	4276(7.5)	154(8.8)	54(8.4)
Primary	17823(30.5)	17295(30.5)	528(30.2)	195(30.3)
Lower secondary	10806(18.5)	10430(18.4)	376(21.5)	144(22.4)
Upper secondary	6130(10.5)	5925(10.4)	205(11.7)	79(12.3)
Higher	3116(5.3)	2988(5.3)	128(7.3)	48(7.5)
<b>Household type, n(%)<sup>*</sup></b>				
Single person	18350(31.4)	17939(31.6)	411(23.5)	161(25.0)
Living together, with no children in household	22020(37.7)	21207(37.4)	813(46.4)	317(49.2)
Living together, with children in household	4219(7.2)	4086(7.2)	133(7.6)	50(7.8)
One-parent family	2981(5.1)	2874(5.1)	107(6.1)	45(7.0)
Other household types	1352(2.3)	1320(2.3)	32(1.8)	13(2.0)
Collective (nursing home. psychiatric hospital)	9554(16.3)	9299(16.4)	255(14.6)	58(9.0)
<b>Urbanisation, n(%)<sup>*</sup></b>				
Very high	17647(30.2)	17157(30.2)	490(28.0)	196(30.4)
High	16302(27.9)	15818(27.9)	484(27.6)	185(28.7)
Average	15970(27.3)	15508(27.3)	462(26.4)	158(24.5)
Low	7283(12.4)	7015(12.4)	268(15.3)	93(14.4)
Rural	866(1.5)	833(1.5)	33(1.9)	9(1.4)
<b>Cause of death, n(%)</b>				
COPD	24401(41.7)	23497(41.4)	904(51.6)	371(57.6)
Cardiovascular diseases	34124(58.3)	33279(58.6)	845(48.3)	273(42.4)
<b>Previous hospitalisations<sup>*</sup></b>				
Mean LOS hospitalisations in the past 2 years until 30 DBD, mean (range)	38.1 (38.2-39.1)	38.9 (38.5-39.2)	46.8 (44.7-48.8)	51.6 (45.5-58.3)
Hospitalisations in the past 2 years until 30 DBD, mean (s.d.)	2.6(2.7)	2.7(2.8)	3.6(3.1)	4.2(3.6)
<b>Charlson Comorbidity Index, n(%)<sup>*</sup></b>				
0	48934(83.6)	48790(85.9)	1441(82.3)	559(86.8)
1	7058(12.1)	6847(12.1)	211(12.1)	52(8.1)
2	2161(3.7)	2083(3.7)	78(4.5)	26(4.0)
≥ 3	374(0.6)	353(0.6)	21(1.2)	7(1.1)
<b>Income, n(%)<sup>‡</sup></b>				
Lowest 40%	6292(10.7)	6107(10.8)	185(10.6)	78(12.1)
41-60%	32905(53.3)	31916(56.2)	989(56.5)	367(57.0)
Highest 39%	19279(33.0)	18702(32.9)	577(33.0)	199(30.9)

Abbreviations: LOS: length of stay (in days); DBD: days before death; s.d.: standard deviation

<sup>\*</sup>Column percentages; <sup>‡</sup>Income percentages represent the proportion of the total population's income.

### Appendix 3.a Bivariate medical resource use results for COPD patients (using palliative home care)

Medical resource use and costs	No PHC#	PHC>30 DBD#	Timing of receiving PHC for the first time in days before death				
			>360#	360-181#	180-91#	90-31#	30-1#
<b>Selected groups, n(%)</b>	<b>56776(97.0)**</b>	<b>644(1.1)**</b>	<b>110*</b>	<b>129*</b>	<b>143*</b>	<b>262*</b>	<b>1107*</b>
<b>Admissions and care interventions</b>							
Hospital admission, n(%)	27169(47.9)	159(24.7)	29(26.4)	32(24.8)	43(30.1)	55(21.0)	n.a.
LOS hospital, mean(CI 95%)	5.3(5.2-5.4)	2.6(2.3-2.9)	3.6(2.4-4.8)	2.5(3.6-2.4)	1.2(2.5-3.6)	1.9(1.2-2.5)	n.a.
ICU admission, n(%)	10884(19.2)	24(3.7)	8(7.3)	3(2.3)	8(5.6)	5(1.9)	n.a.
LOS ICU, mean(CI 95%)	1.0(0.9-1.0)	0.1(0.1-0.2)	0.2(0.0-0.3)	0.2(0.2-0.0)	0.0(0.2-0.2)	0.1(0.0-0.2)	n.a.
Palliative care unit admission, n(%)	780(1.4)	49(7.6)	5(4.6)	9(7.0)	14(9.8)	21(8.0)	n.a.
LOS Palliative care unit, mean(CI 95%)	0.1(0.1-0.1)	0.3(0.2-0.4)	0.9(0.3-1.5)	1.1(0.9-0.3)	0.4(1.1-0.9)	0.8(0.4-1.1)	n.a.
ODC admission, n(%)	1208(2.1)	6(0.9)	1(0.9)	2(1.6)	1(0.7)	2(0.8)	n.a.
ER admission, n(%)	22360(39.4)	126(19.6)	26(23.6)	24(18.6)	34(23.8)	42(16.0)	n.a.
Home care, n(%)	18294(32.2)	471(73.1)	74(67.3)	92(71.3)	105(73.4)	200(76.3)	n.a.
GP contact, n(%)	42818(75.4)	587(91.1)	98(89.1)	118(91.5)	132(92.3)	239(91.2)	n.a.
Number of GP contacts, mean(CI 95%)	2.4(2.4-2.4)	5.7(5.5-5.9)	4.8 (4.1-5.4)	6.3(4.8-4.1)	5.1(6.3-4.8)	5.7(5.1-6.3)	n.a.
Specialist contact, n(%)	9566(16.9)	59(9.2)	15(13.6)	15(11.6)	12(8.4)	17(6.5)	n.a.
Number of specialist contacts, mean(CI 95%)	0.2(0.2-0.2)	0.1(0.1-0.2)	0.1(0.0-0.2)	0.1(0.1-0.0)	0.0(0.1-0.1)	0.1(0.0-0.1)	n.a.
Physiotherapist contact, n(%)	28643 (50.5)	358(55.6)	57(51.8)	81(62.8)	81(56.6)	139(53.1)	n.a.
Number of physiotherapist contacts, mean(CI 95%)	5.7 (5.6-5.8)	5.5(5.1-5.8)	7.6(5.9-9.2)	7.4(7.6-5.9)	5.3(7.4-7.6)	6.3(5.3-7.4)	n.a.
<b>Procedures</b>							
Invasive ventilation, n(%)	4864(8.6)	8(1.2)	4(3.6)	0(0.0)	2(1.4)	2(0.8)	n.a.
Non-invasive ventilation, n(%)	13795(24.0)	394(61.2)	58(52.7)	87(67.4)	86(60.1)	163(62.2)	n.a.
Gastric tube, n(%)	116(0.2)	3(0.5)	0(0.0)	1(0.8)	2(1.4)	0(0.0)	n.a.
Urinary tract catheter, n(%)	202(0.4)	3(0.5)	1(0.9)	1(0.8)	1(0.7)	0(0.0)	n.a.
CPR, n(%)	1031(2.0)	2(0.3)	1(0.9)	0(0.0)	0(0.0)	1(0.4)	n.a.
Medical imaging, n(%)	34010(60.0)	174(27.0)	38(34.6)	38(29.5)	41(28.7)	57(21.8)	n.a.
Chest radiograph, n(%)	31757(56.0)	162(25.2)	35(31.8)	37(28.7)	39(27.3)	51(19.5)	n.a.
Number chest radiograph, mean(CI 95%)	2.6(2.5-2.6)	0.7(0.6-0.8)	0.7(0.4-1.0)	0.5(0.7-0.4)	0.2(0.5-0.7)	0.4(0.2-0.5)	n.a.
Spirometry, n(%)	66(0.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	n.a.
<b>Medication</b>							
Oxygen, n(%)	3473(6.1)	90(14.0)	13(11.8)	21(16.3)	18(12.6)	38(14.5)	n.a.
Opioids, n(%)	18775(33.1)	430(66.8)	65(59.1)	87(67.4)	98(68.5)	180(68.7)	n.a.
Sedatives, n(%)	11357(20.0)	81(12.6)	13(11.8)	14(10.9)	22(15.4)	32(12.2)	n.a.
Morphine, n(%)	7465(13.2)	279(43.3)	33(30.0)	57(44.2)	65(45.5)	124(47.3)	n.a.
COPD drugs, n(%)	35319(62.2)	411(63.8)	76(69.1)	82(63.6)	95(66.4)	158(60.3)	n.a.
<b>Place of death*</b>							
Hospital death, n(%)	31225(55.0)	274(15.6)	38(34.5)	37(28.7)	47(32.9)	68(26.0)	84(7.6)
Home death, n(%)	14731(25.9)	1064(60.8)	48(43.6)	72(55.8)	72(50.3)	158(60.3)	714(64.5)
Death in nursing home of residence, n(%)	10820(19.1)	413(23.6)	24(21.8)	20(15.5)	24(16.8)	36(13.7)	309(27.9)

Abbreviations: PHC: palliative home care; DBD: Days before death; LOS: length of stay (in days); ICU: intensive care unit; ODC: one day care; GP: general practitioner; CPR: cardiopulmonary resuscitation; n.a.: not applicable. #column percentages; #Column percentages; \*Place of death is calculated for all PHC users, including those who used it <30days before death. \*\*Amount and percentage of total study population, n=58,52; \*Amount and percentage of those receiving PHC, n=1751.

### Appendix 3.b Multivariate medical resource use results for COPD patients (using palliative home care use and timing)

Medical resource use and costs	PHC vs no PHC OR <sup>a</sup> (CI 95%)	>360 DBD vs no PHC OR <sup>a</sup> (CI 95%)	360-181 DBD vs no PHC OR <sup>a</sup> (CI 95%)	180-91 DBD vs no PHC OR <sup>a</sup> (CI 95%)	90-31 DBD vs no PHC OR <sup>a</sup> (CI 95%)
<b>Admissions and care interventions</b>					
Hospital admission	0.35(0.32-0.40)	0.53(0.34-0.82)	0.43(0.28-0.65)	0.48(0.33-0.69)	0.28(0.20-0.37)
LOS hospital admission	0.38(0.34-0.42)	0.55(0.36-0.84)	0.44(0.29-0.66)	0.53(0.37-0.75)	0.28(0.21-0.38)
ICU admission	0.16(0.12-0.20)	0.50(0.23-1.06)	0.14(0.04-0.44)	0.24(0.12-0.51)	0.08(0.04-0.21)
LOS ICU admission	0.16(0.12-0.20)	0.5(0.23-1.04)	0.14(0.04-0.44)	0.24(0.11-0.50)	0.08(0.03-0.20)
Palliative care unit admission	2.61(2.01-3.39)	2.34(0.89-6.14)	4.05(1.96-8.36)	5.50(3.07-9.86)	4.99(3.14-7.95)
LOS Palliative care unit	2.63(2.04-3.45)	2.38(0.91-6.25)	4.35(2.13-9.09)	5.56(3.13-10)	5.26(3.33-8.33)
ODC admission	not enough cases	not enough cases	not enough cases	not enough cases	not enough cases
ER admission	0.43(0.38-0.48)	0.59(0.38-0.93)	0.39(0.25-0.61)	0.49(0.33-0.72)	0.28(0.20-0.39)
Home care	3.27(2.91-3.66)	0.64(0.34-1.20)	0.91(0.54-1.55)	1.99(1.28-3.09)	3.68(2.70-5.01)
GP contact	4.65(3.77-5.74)	1.36(0.72-2.55)	2.05(1.09-3.87)	3.34(1.76-6.36)	2.91(1.89-4.51)
Number of GP contacts	5.26(4.76-5.88)	1.33(0.91-1.85)	2.94(2.13-4)	2.86(2.13-3.85)	4.76(4.00-6.25)
Specialist contact	0.58(0.50-0.69)	1.09(0.61-1.93)	0.80(0.46-1.40)	0.51(0.28-0.93)	0.32(0.20-0.53)
Number of specialist contacts	0.61(0.52-0.72)	1.14(0.65-2.00)	0.82(0.47-1.43)	0.53(0.29-0.96)	0.37(0.23-0.61)
Physiotherapist contact	0.94(0.85-1.04)	0.68(0.45-1.01) <sup>§</sup>	1.19(0.82-1.74) <sup>§</sup>	0.86(0.61-1.21) <sup>§</sup>	0.84(0.65-1.08) <sup>§</sup>
Number of physiotherapist contacts	0.81(0.74-0.89)	0.62(0.43-0.89)	1.11(0.81-1.54)	0.81(0.60-1.10)	0.81(0.65-1.02)
<b>Procedures</b>					
Invasive ventilation	0.13(0.08-0.21)	0.70(0.25-1.97)	not enough cases	0.21(0.05-0.88)	0.10(0.03-0.40)
Non-invasive ventilation	2.65(2.39-2.93)	1.38(0.91-2.10)	3.27(2.20-4.85)	2.67(1.87-3.81)	3.47(2.67-4.51)
Gastric tube	2.15(1.11-4.16)	not enough cases	not enough cases	not enough cases	not enough cases
Urinary tract catheter	1.02(0.44-2.34)	3.70(0.47-28.87)	3.14(0.40-24.47)	2.25(0.30-17.05)	not enough cases
CPR	0.09(0.02-0.36)	1.18(0.16-8.73)	not enough cases	not enough cases	0.28(0.04-2.05)
Medical imaging	0.34(0.31-0.38)	0.53(0.35-0.81)	0.36(0.24-0.54)	0.24(0.16-0.35)	0.15(0.11-0.21)
Chest radiograph	0.34(0.31-0.38)	0.53(0.35-0.82)	0.41(0.27-0.61)	0.27(0.18-0.40)	0.16(0.12-0.22)
Number chest radiograph	0.34(0.31-0.38)	0.51(0.33-0.77)	0.40(0.27-0.59)	0.29(0.2-0.42)	0.17(0.12-0.23)
Spirometry	not enough cases	not enough cases	not enough cases	not enough cases	not enough cases
<b>Medication</b>					
Oxygen	2.22(1.89-2.61)	0.92(0.48-1.76)	2.17(1.27-3.71)	1.96(1.14-3.37)	2.27(1.56-3.30)
Opioids	4.04(3.63-4.49)	1.83(1.22-2.73)	2.70(1.84-3.96)	3.11(2.16-4.46)	3.50(2.68-4.58)
Sedatives	0.48(0.41-0.57)	0.74(0.41-1.34)	0.61(0.34-1.07)	0.72(0.45-1.15)	0.54(0.37-0.79)
Morphine	5.29(4.78-5.86)	2.86(1.90-4.31)	5.02(3.54-7.11)	5.29(3.80-7.36)	5.86(4.59-7.48)
COPD drugs	0.97(0.87-1.07)	1.24(0.81-1.88)	0.93(0.64-1.36)	0.95(0.67-1.36)	0.74(0.58-0.96)
<b>Place of death</b>					
Hospital death	0.14(0.13-0.16)	0.66(0.43-1.01)	0.44(0.29-0.66)	0.38(0.26-0.55)	0.26(0.19-0.34)
Home death	4.77(4.29-5.30)	0.73(0.46-1.14)	1.71(1.15-2.54)	2.12(1.47-3.05)	4.36(3.34-5.69)
Death in nursing home of residence	1.72(1.50-1.96)	3.97(2.17-7.29)	1.81(0.99-3.33)	1.93(1.14-3.26)	1.04(0.70-1.56)

Abbreviations: PHC: palliative home care; DBD: days before death; ICU: intensive care unit; ODC: one day care; GP: general practitioner; CPR: cardiopulmonary resuscitation.

#Column percentages. <sup>§</sup>not significant \*Odds Ratios with reference category: no palliative home care, controlled for age, household type, attained educational level, urbanization, year of death, amount of comorbidity, amount of home care visits with a palliative character from a community nurse in the last 360 days before death and care intensity parameters in the last 365 days before death (Appendix 1).

## Appendix 4. Strobe checklist

### STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	2-3
Objectives	3	State specific objectives, including any prespecified hypotheses	2
Methods			
Study Design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3-4
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	3-4
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) Cohort study—For matched studies, give matching criteria and number of exposed and unexposed	
		Case-control study—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3-4
Bias	9	Describe any efforts to address potential sources of bias	3-4
Study Size	10	Explain how the study size was arrived at	3-5
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	3-4
Statistical Methods	12	(a) Describe all statistical methods, including those used to control for confounding	3-4
		(b) Describe any methods used to examine subgroups and interactions	3-4
		(c) Explain how missing data were addressed	3-4
		(d) Cohort study—If applicable, explain how loss to follow-up was addressed	3-4
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	/
		(c) Consider use of a flow diagram	/
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	5
		(b) Indicate number of participants with missing data for each variable of interest	/
		(c) Cohort study—Summarise follow-up time (eg, average and total amount)	/
Outcome Data	15*	Cohort study—Report numbers of outcome events or summary measures over time	5-6
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	