Appendix 1: Nurse time use and the association with the number of medications, dispensings, and administrations

Introduction

This appendix reports the findings of the linear regression analyses to explore the associations between the number of medications, dispensings and administrations and the time use of nurses.

We assume that the association between time use and activities can be represented by a linear regression, where time use, **t**, is determined by a fixed component, ***a***, and a variable component, **N**, e.g. number of medications, where ***b*** is the average additional cost per medication and ***e*** is the error term:

$$t = a + b*N + e \quad (1)$$

For each time use activity we assess the presence of the fixed and variable components based on the significance of the coefficients ***a*** (fixed component) and ***b*** (variable component) using a threshold of $p \leq 0.05$.

It could be considered that the time it takes to perform various tasks depends on the nurse's level of experience. On the other hand, compared to many other nursing tasks, dispensing and administration of medicine are relatively small, frequent and simple tasks where experience can quickly be obtained. For that reason and due to small sample size we did not adjust for nursing experience.

SAM START-UP

To start SAM the nurse will meet with the patient and provide instructions of general nature as well as go through the medications one by one. We hypothesize that there is a fixed component as well as a positive association between time use and number of medications, i.e. $a > 0$ and $b > 0$.

SAM start-up time (seconds)		
	Coef.	**P-value**
Constant	384.06	0.050
Number of self-administered medications	155.84	0.000
R-squared	0.5525	

Conclusion

We find that both the constant term and the number of medications contribute significantly to the time use ($p \leq 0.05$; Table above). Therefore the nurse time used on SAM start-up can be expressed by the formula, where N is the number of self-administered medications:

$$t = 384.1sec + 155.8sec*N \quad (2)$$

Converted to minutes, this means that there is a fixed time of 6.4 minutes used for all patients irrespective of number of medications, and a variable component of 2.6 minutes per medication. We therefore use equation (2) to predict time use in the full sample based on number of medications.

DISPENSING

Nurses dispense medication to the patients one or more times per day. Each time he or she may dispense one or several medications and we would expect the time use to depend primarily on number of medications and doses during the day. We hypothesize that $a = 0$ and $b > 0$.

Time use per dispensing (measured for the control group) (seconds):		
	Coef.	**P-value**
Constant	15.45	0.56
Number of dispensed medications	29.08	0.000
R-squared	0.2401	

Conclusion:

From the regression analysis we see, that time used on dispensing is statistically significantly associated with the number of dispensed medications. The coefficient to the constant term was not significant, so we exclude it and use the mean time use (32.8 sec; SD:21.0sec) per dispensing to estimate the total time use for the full sample (expressed by formula (3), where N is the number of dispensed medications):

(3) $t=32.8sec*N$

Converted to minutes, this means a nurse time use of 0.6 minutes per dispensed medication.

ADMINISTRATION
Administration of medication consists of the nurse picking up the already dispensed medications and administering it to the patient. This process is expected to be less dependent on number of medications. We hypothesize that $a > 0$ and $b = 0$.

Time use per administration (measured for the control group) (seconds):		
	Coef.	**P-value**
Constant	50.24	0.10
Number of administered medications	6.52	0.29
R-squared	0.0584	

Conclusion
From the regression analyses we see, that the time use is not associated with the number of medications. We therefore used the mean time use (78.2 sec; SD 59.8 sec) per administration when estimating the total time use for administration in the full sample (expressed in the formula (4), where N is the number of administrations (medication rounds)).

(4) $t=78.2sec*N$

Converted to minutes, this means a nurse time use of 1.3 minutes per administration.

DISCHARGE
The preparation of discharge consists of a general discussion with the patient about the admission and what will happen after discharge and will also include instructions on medication. We expect that the time use will vary between the intervention who is already using familiar medication, and the control group. We therefore analyse the groups separately.

Time use at discharge (Intervention group) (seconds):		
	Coef.	**P-value**
Constant	1804.56	0.008
Number of medications	-19.42	0.83
R-squared	0.0031	

Discharge (Control group) (seconds):		
	Coef.	**P-value**
Constant	2389.67	0.009
Number of medications	-36.31	0.82
R-squared	0.0040	

Conclusion:
From the analyses we see, that there appears to be no significant association with the number of medications in either of the groups. Therefore we use the mean nurse time used on discharge for each of the groups to estimate the time use for the full sample:

<u>Intervention group (n=19):</u>

(5) t=1653.1 sec (SD: 1036.sec)

Converted to minutes, this means a nurse time use of 27.6 minutes per discharge.

Control group (n=16):

(6) t= 2221.8 sec (SD: 1402.6sec)

Converted to minutes, this means a nurse time use of 37.0 minutes per discharge.

Appendix 2: Sensitivity analyses

Variation	Total cost (2018€)		Incremental cost (I-C)	Change in conclusion
	Intervention	Control		
Minimum/Maximum analyses (Base case -2.7 €)				
C_{new} minimum value is used, others are the same	47.28	49.35	-2.08	Fewer savings
C_{new} maximum value is used, others are the same	52.48	55.84	-3.36	Additional savings
C_{usual} minimum value is used, others are the same	48.55	50.47	-1.92	Fewer savings
C_{usual} maximum value is used, others are the same	51.20	54.72	-3.52	Additional savings
C_{m} minimum value is used, others are the same	49.84	52.53	-2.69	No change
C_{m} maximum value is used, others are the same	49.91	52.66	-2.75	No change
C_{disp} minimum value is used, others are the same	49.59	50.82	-1.23	Fewer savings
C_{disp} maximum value is used, others are the same	50.16	54.37	-4.21	Additional savings
C_{adm} minimum value is used, others are the same	49.43	51.58	-2.16	Fewer savings
C_{adm} maximum value is used, others are the same	50.32	53.61	-3.29	Additional savings
$C_{SAMstart}$ minimum value is used, others are the same	48.98	52.59	-3.61	Additional savings
$C_{SAMstart}$ maximum value is used, others are the same	50.77	52.59	-1.83	Fewer savings
$C_{discharge}$ minimum value is used, others are the same	44.74	44.92	-0.17	Fewer savings

$C_{discharge}$ maximum value is used, others are the same	55.01	60.27	-5.26	Additional savings
Change in assumptions				
The participant brings and uses al their usual medication. The hospital only has to provide new medication.	46.15	52.59	-6.44	Additional savings
Unit labor cost changed to 40.69 € per hour *	53.18	56.44	-3.26	Additional savings
Only costs for nursing time	32.86	38.26	-5.40	Additional savings

*Average hourly labor cost for a Danish nurse (Source: Dansk Sygepleje Råd 2019)