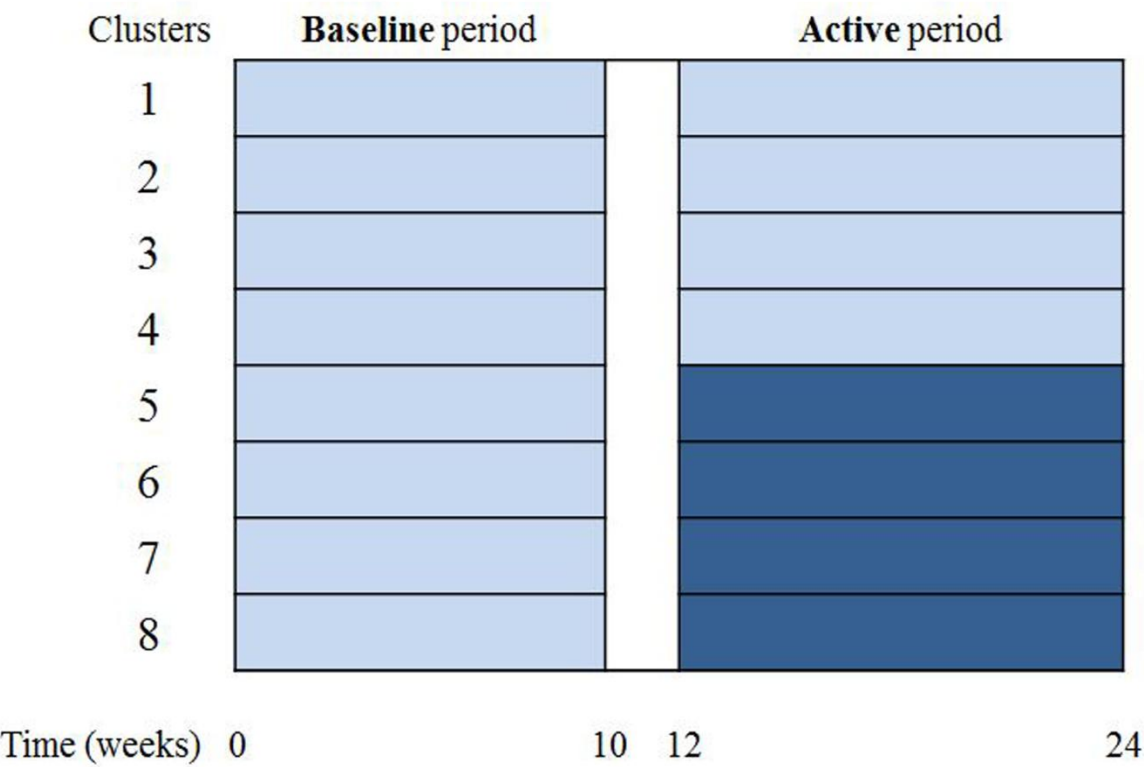


SUPPLEMENTARY DATA

Supplementary Figure S1. RAPIDS study design: Parallel cluster-randomized study with a baseline period. There was a 10-week baseline period, and 12-weeks active period. Light shading represents clusters unexposed to the intervention (i.e. usual care). Dark shading represents clusters exposed to the intervention (i.e. early identification and management). Between weeks 10 to 12 constituted the transition period where implementation of the intervention occurred and no patient recruitment was conducted.



SUPPLEMENTARY DATA

Supplementary Table S1. Primary analysis Individual level: Number of Adjusted AGD per-patient. Mixed model Poisson regression where ward (cluster) was included as random variable. Group (control-baseline period, control-active period, intervention-baseline period, and intervention-active period) was included as a factor to allow simultaneous comparison across treatment arms and between baseline and active periods within each treatment arm. IRR = incidence rate ratio.

	β-Coefficient (95%CI)	IRR (95% CI)	p-value
Age	0.009 (0.004, 0.013)	1.009 (1.004, 1.013)	<0.001
Male	0.102 (-0.017, 0.221)	1.107 (0.983, 1.248)	0.094
Modified Charlson Index *	0.062 (0.029, 0.094)	1.063 (1.029, 1.098)	<0.001
Creatinine	0.000 (0.000, 0.001)	1.000 (0.999, 1.001)	0.553
HbA1c (each % increase)	0.203 (0.174, 0.232)	1.225 (1.190, 1.261)	<0.001
Diabetes Type	-0.252 (-0.368, -0.137)	0.777 (0.692, 0.872)	<0.001
Insulin treatment prior to admission	0.601 (0.475, 0.727)	1.823 (1.607, 2.068)	<0.001
Surgical unit admission	-0.111 (-0.336, 0.133)	0.895 (0.701, 1.143)	0.372
Elective admission	-0.246 (-0.500, 0.008)	0.782 (0.606, 1.008)	0.057
Surgical ward	0.038 (-0.203, 0.278)	1.038 (0.817, 1.320)	0.759
Number of observed days	0.148 (0.134, 0.163)	1.160 (1.143, 1.177)	<0.001
Constant	-2.536 (-3.057, -2.014)	0.079 (0.047, 0.133)	<0.001
Ward (random variable)	9.37 ⁻³³	0.000	
Group			
Control-baseline (usual care)	0.038 (-0.122, 0.199)	1.039 (0.885, 1.220)	0.640
Control-active (usual care)	-0.056 (-0.217, 0.106)	0.946 (0.805, 1.112)	0.501
Intervention-baseline (usual care)	Ref	Ref	
Intervention-active (proactive care)	-0.283 (-0.453, -0.112)	0.754 (0.636, 0.894)	0.001

* modified Charlson index excludes items related to diabetes

SUPPLEMENTARY DATA

Comparison between groups	β -coef (95%CI)	IRR (95%CI)	p
Control-baseline period vs. Control-active period (change in control arm)	-0.094 (-0.248, +0.060)	0.910 (0.780, 1.062)	0.233
Intervention-baseline period vs. Intervention-active period (change in intervention arm)	-0.283 (-0.453, -0.112)	0.754 (0.636, 0.894)	0.001
Control-active period vs. Intervention-active period (comparison of early intervention against parallel control group)	-0.227 (-0.395, -0.059)	0.797 (0.674, 0.942)	0.008

Supplementary Table S2. Adjusted* Adverse Glycaemic Days per patient during baseline and active periods by clusters

Control Clusters	Baseline	Active	P [#]	Intervention Clusters	Baseline	Active	P [#]
C1-General medicine	2.0±2.5	2.1±2.6	0.96	I1-General Medicine	2.2±2.3	1.4±1.3	0.01
C2-General surgery	1.8±1.9	1.0±0.6	0.05	I2-General Surgery	0.8±0.8	0.7±0.5	0.40
C3-Cardiology	1.6±1.7	1.4±1.2	0.53	I3-Neurology	1.6±1.4	1.1±0.9	0.02
C4-Orthopaedic	1.6±1.4	1.3±1.4	0.20	I4-Neurosurgery	0.9±0.8	0.8±0.7	0.43

*adjusted for age, gender, modified Charlson index, creatinine, HbA1c, insulin treatment prior to admission, admission unit, admission type, ward type, days observed (fixed effects), and ward (random effect)

Kruskal-Wallis rank-sum test

SUPPLEMENTARY DATA

Supplementary Table S3. Post-hoc analysis: Hospital-acquired infections. Mixed model logistic regression where ward (cluster) was included as random variable. Group (control-baseline period, control-active period, intervention-baseline period, and intervention-active period) was included as a factor to allow simultaneous comparison across treatment arms and between baseline and active periods within each treatment arm.

	Adj OR	95% CI	p-value
Age (each 1 year increase)	1.03	1.00, 1.06	0.033
Male	1.65	0.84, 3.25	0.143
Modified Charlson Index [#] (each 1 point increase)	1.08	0.90, 1.29	0.427
Creatinine (each 10 umol/L increase)	1.00	1.00, 1.00	0.898
HbA1c (each % increase)	1.13	0.92, 1.38	0.239
Diabetes Type			
- Type 2 diabetes	1.00	ref	ref
- Type 1 diabetes	0.35	0.04, 3.03	0.343
- New hyperglycaemia	3.79	1.12, 12.76	0.032
Insulin treatment prior to admission	0.55	0.23, 1.34	0.188
Surgical unit admission	0.76	0.19, 3.12	0.708
Elective admission	1.50	0.47, 4.76	0.490
Surgical ward	1.52	0.35, 6.52	0.577
Number of observed days (each 1 day increase)	1.40	1.28, 1.54	<0.001
Constant	0.00	0.000, 0.003	<0.001
Ward (random variable)	0.08		
Group			
Control-baseline (usual care)	1.24	0.48, 3.14	0.654
Control-active (usual care)	0.89	0.34, 2.28	0.792
Intervention-baseline (usual care)	Ref	Ref	
Intervention-active (proactive care)	0.20	0.07, 0.58	0.003

modified Charlson index excludes items related to diabetes

SUPPLEMENTARY DATA

Comparison between groups	Adj OR [95%CI]	p
Control-baseline period vs. Control-active period (change in control arm)	0.71 [0.31, 1.63]	0.420
Intervention-baseline period vs. Intervention-active period (change in intervention arm)	0.20 [0.07, 0.58]	0.003
Control-active period vs. Intervention-active period (comparison of early intervention against parallel control group)	0.23 [0.07, 0.73]	0.013

Supplementary Table S4. Post-hoc analysis: Hospital-acquired infections (subgroup of patients with type 2 diabetes). Mixed model logistic regression where ward (cluster) was included as random variable. Group (control-baseline period, control-active period, intervention-baseline period, and intervention-active period) was included as a factor to allow simultaneous comparison across treatment arms and between baseline and active periods within each treatment arm.

	Adj OR	95% CI	p-value
Age (each 1 year increase)	1.04	1.01, 1.08	0.016
Male	1.71	0.83, 3.52	0.144
Modified Charlson Index [#] (each 1 point increase)	1.08	0.90, 1.31	0.409
Creatinine (each 10 umol/L increase)	1.00	0.99, 1.00	0.680
HbA1c (each % increase)	1.18	0.95, 1.46	0.138
Insulin treatment prior to admission	0.47	0.18, 1.21	0.117
Surgical unit admission	0.77	0.18, 3.33	0.729
Elective admission	1.34	0.39, 4.67	0.643
Surgical ward	1.95	0.44, 8.62	0.378
Number of observed days (each 1 day increase)	1.42	1.28, 1.56	<0.001
Constant	0.00	0.000, 0.002	<0.001
Ward (random variable)	0.04		
Group			
Control-baseline (usual care)	1.37	0.55, 3.39	0.497
Control-active (usual care)	0.67	0.25, 1.78	0.420
Intervention-baseline (usual care)	Ref	Ref	
Intervention-active (proactive care)	0.17	0.05, 0.56	0.003

modified Charlson index excludes items related to diabetes

SUPPLEMENTARY DATA

Comparison between groups	Adj OR [95%CI]	p
Control-baseline period vs. Control-active period (change in control arm)	0.49 [0.20, 1.19]	0.114
Intervention-baseline period vs. Intervention-active period (change in intervention arm)	0.17 [0.05, 0.56]	0.003
Control-active period vs. Intervention-active period (comparison of early intervention against parallel control group)	0.26 [0.08, 0.89]	0.033

Supplementary Table S5. Glycaemic and Clinical outcomes for subgroup of patients with Type 2 diabetes

	Control arm (4 clusters)			Intervention arm (4 clusters)		
	Baseline Period	Active Period	p	Baseline Period	Active Period	p
	(usual care)	(usual care)		(usual care)	(Early/proactive intervention)	
Glucometric outcomes						
Patient-days	n=1131	n=1264		n=1053	n=1396	
Patient-day mean BG (mean±sd)	9.6±3.3	9.4±3.1	0.10	9.2±3.2	9.0±2.7	0.296
mean BG > 10 mmol/L [>180 mg/dL]	36%	36%	0.90	32%	30%	0.370
mean BG > 15 mmol/L [>270 mg/dL]	7.0%	5.6%	0.18	6.6%	3.2%	<0.001
BG <4 mmol/L [<72 mg/dL]	4.3%	4.1%	0.79	3.0%	3.9%	0.27
BG <3 mmol/L [<54 mg/dL]	1.0%	1.0%	0.89	0.7%	0.4%	0.42
Clinical outcomes						
Patients	n=193	n=241		n=190	n=247	
Any hospital-acquired infection	18 (9.3)	16 (6.4)	0.37	13 (6.8)	6 (2.4)	0.032
Acute kidney injury	14 (7.3)	19 (7.9)	0.86	11 (5.8)	9 (3.7)	0.36
Acute myocardial infarct	3 (1.6)	4 (1.7)	0.99	2 (1.1)	1 (0.4)	0.58
Unplanned critical care admission	10 (5.1)	9 (3.7)	0.49	2 (1.1)	2 (0.8)	0.99
Hospital mortality	3 (1.6)	7 (2.9)	0.52	5 (2.6)	4 (1.6)	0.51
Composite outcome	35 (18.1)	43 (17.8)	0.99	26 (13.7)	21 (8.5)	0.09
Length of stay (days)	6 (3, 11)	6 (3, 10)	0.47	5 (3, 10)	6 (3, 11)	0.14

Data expressed as mean±sd, median (Q1, Q3), or n (%). P-values using t-test or Fisher's exact test as appropriate

SUPPLEMENTARY DATA

Supplementary Table S6. Glycaemic and clinical outcomes for subgroup of patients with Type 1 diabetes

	Control arm (4 clusters)			Intervention arm (4 clusters)		
	Baseline Period	Active Period	p	Baseline Period	Active Period	p
	(usual care)	(usual care)		(usual care)	(Early/proactive intervention)	
Glucometric outcomes						
Patient-days	n=55	n=53		n=34	n=28	
Patient-day mean BG (mean±sd)	10.6±3.1	10.5±3.0	0.88	10.3±3.2	10.7±3.3	0.64
mean BG > 10 mmol/L [>180 mg/dL]	60%	57%	0.72	44%	54%	0.61
mean BG > 15 mmol/L [>270 mg/dL]	9.1%	7.6%	0.99	15%	14%	0.99
BG <4 mmol/L [<72 mg/dL]	22%	13%	0.31	29%	32%	0.82
BG <3 mmol/L [<54 mg/dL]	11%	4%	0.27	12%	17%	0.72
Clinical outcomes						
Patients	n=18	n=19		n=16	n=12	
Any hospital-acquired infection	0	0		1 (6)	0	0.99
Acute kidney injury	0	2 (11)	0.49	0	0	
Acute myocardial infarct	1 (6)	0	0.49	0	0	
Unplanned critical care admission	2 (11)	1 (5)	0.60	0	0	
Hospital mortality	0	1 (5)	0.99	0	0	
Composite outcome	2 (11)	4 (21)	0.66	1 (6)	0	0.99
Length of stay (days)	5 (3, 13)	4 (3, 9)	0.64	4 (2, 14)	5 (3, 5)	0.59

Data expressed as mean±sd, median (Q1, Q3), or n (%). P-values using t-test or Fisher's exact test as appropriate

SUPPLEMENTARY DATA

Supplementary Table S7. Glycaemic and clinical outcomes for subgroup of patients with New Hyperglycaemia

	Control arm (4 clusters)			Intervention arm (4 clusters)		
	Baseline Period	Active Period	p	Baseline Period	Active Period	p
	(usual care)	(usual care)		(usual care)	(Early/proactive intervention)	
Glucometric outcomes						
Patient-days	n=53	n=48		n=46	n=139	
Patient-day mean BG (mean±sd)	9.3±2.5	9.9±3.9	0.35	11.3±4.1	8.7±2.5	<0.001
mean BG > 10 mmol/L [>180 mg/dL]	32%	38%	0.57	48%	22%	0.001
mean BG > 15 mmol/L [>270 mg/dL]	1.9%	14.6%	0.03	17.4%	2.2%	0.001
BG <4 mmol/L [<72 mg/dL]	0	2.1%	0.47	0	0	
BG <3 mmol/L [<54 mg/dL]	0	0		0	0	
Clinical outcomes						
Patients	n=10	n=10		n=14	n=28	
Any hospital-acquired infection	1 (10)	3 (30)	0.59	0	1 (4)	0.99
Acute kidney injury	1 (10)	1 (10)	0.99	0	2 (7)	0.55
Acute myocardial infarct	0	1 (10)	0.99	0	0	
Unplanned critical care admission	0	2 (20)	0.47	0	1 (4)	0.99
Hospital mortality	2 (20)	0	0.47	1 (7)	2 (7)	0.99
Composite outcome	2 (20)	4 (40)	0.63	1 (7)	5 (18)	0.65
Length of stay (days)	5 (3, 7)	11 (4, 18)	0.31	7 (4, 11)	7 (3, 10)	0.97

Data expressed as mean±sd, median (Q1, Q3), or n (%). P-values using t-test or Fisher's exact test as appropriate

SUPPLEMENTARY DATA

Supplementary Table S8. Subgroup analysis of clinical outcomes: medical vs. surgical patients

	Control arm (4 clusters)			Intervention arm (4 clusters)		
	Baseline Period	Active Period	p	Baseline Period	Active Period	p
	(usual care)	(usual care)		(usual care)	(Early/proactive intervention)	
Medical Patients	n=168	n=194	p*	n=114	n=169	p*
Any hospital-acquired infection	12 (7.1)	9 (4.6)	0.37	12 (10.5)	6 (3.6)	0.025
Acute kidney injury	12 (7.1)	12 (8.3)	0.84	9 (7.9)	7 (4.1)	0.20
Acute myocardial infarct	2 (1.9)	4 (2.1)	0.69	1 (0.9)	1 (0.6)	0.99
Unplanned critical care admission	9 (5.4)	9 (4.6)	0.81	1 (0.9)	2 (1.2)	0.99
Hospital mortality	5 (3.0)	8 (4.1)	0.59	5 (4.4)	6 (3.6)	0.76
Composite outcome	28 (16.7)	38 (19.6)	0.50	24 (21.1)	21 (12.4)	0.07
Length of stay (days)	5 (3, 10)	6 (3, 12)	0.54	8 (4, 12)	8 (4, 14)	0.44
Surgical Patients	n=53	n=76		n=106	n=122	
Any hospital-acquired infection	7 (13.2)	10 (13.2)	0.99	2 (1.9)	1 (0.8)	0.60
Acute kidney injury	3 (5.7)	6 (7.9)	0.73	2 (1.9)	4 (3.3)	0.69
Acute myocardial infarct	2 (3.8)	1 (1.3)	0.57	1 (0.9)	0	0.46
Unplanned critical care admission	3 (5.7)	3 (4.0)	0.69	1 (0.9)	1 (0.8)	0.99
Hospital mortality	0	0		1 (9.4)	0	0.46
Composite outcome	11 (20.8)	13 (17.1)	0.65	4 (3.8)	5 (4.1)	0.99
Length of stay (days)	9 (4, 14)	5 (4, 9)	0.03	4 (2, 7)	5 (2, 7)	0.51

Data expressed as mean±sd, median (Q1, Q3), or n (%). P-values using Fisher's exact test.

SUPPLEMENTARY DATA

Supplementary Table S9. Insulin-naïve patients that received insulin treatment in hospital

	Control arm (4 clusters)		Intervention arm (4 clusters)	
	Baseline Period	Active Period	Baseline Period	Active Period
	(Usual care)	(Usual care)	(Usual care)	(Early/ proactive intervention)
Medical units				
- General medicine	12/34 (35)	17/40 (43)	18/42 (43)	47/67 (70)
- Cardiology	13/41 (32)	25/61 (41)	0/0	1/1 (100)
- Neurology	0/0	1/3 (33)	15/39 (39)	30/56 (54)
- Respiratory	11/19 (58)	7/14 (50)	0/0	0/1 (0)
- Gastroenterology	4/10 (40)	3/6 (50)	1/2 (50)	0/4 (0)
- Other medical	1/3 (33)	1/1 (100)	1/3 (33)	0/0
Surgical units				
- Abdominal & emergency general surgery	3/11 (27)	9/16 (56)	8/36 (22)	28/52 (50)
- Neurosurgery	0/0	0/0	11/34 (32)	17/32 (53)
- Orthopedics & Trauma	7/24 (29)	7/33 (21)	2/7 (29)	3/5 (60)
- Other surgery	0/0	0/2 (0)	1/6 (17)	1/3 (33)
TOTAL	51/142 (36)	70/176 (40)	57/169 (34)	127/221 (57)

Data presented as: number that received insulin / total number of patients (percentage)