Clinical Nutrition 33 (2014) 495–501

Contents lists available at SciVerse ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Systematic screening for undernutrition in hospitals: Predictive factors for success☆

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ARTICLE INFO

Article history:
Received 1 May 2013
Accepted 5 July 2013

Keywords:
Malnutrition
Screening
Hospitals
Performance indicator
Prevalence
Quality of care

SUMMARY

Background & aims: Since 2007, systematic screening for undernutrition has become a performance indicator (PI) for hospitals within the National Benchmarks on Quality of Care of the Dutch Health Care Inspectorate (HCI). Its introduction was guided by a national implementation program. The aim of this study was to evaluate the screening results from 2007 to 2010 and to identify predictive factors for achieved screening results.

Methods: All 97 Dutch hospitals were obliged to report screening results to the HCI. An additional questionnaire was developed to determine hospital characteristics, including hospital type, size, participation in implementation program, screening tool used, use of electronic records, presence of hospital-wide or ward task forces, and protocol-defined referral. Multivariate linear regression analysis was used to identify predictive factors for the obtained screening results in 2010.

Results: The mean screening percentage increased from 51 ± 28% in 2007 ($n = 75$ hospitals, $n = 340{,}000$ patients) to 72 ± 17% in 2010 ($n = 97$; $n = 1{,}050{,}000$) ($p < 0.01$). Eighty-one hospitals returned the questionnaire. A higher screening percentage was associated with more clinical admissions (highest vs. lowest tertile: $\beta = 14.0$, 95% CI 3.9–20.5; $p < 0.01$; middle vs. lowest: $\beta = 7.3$, −0.8 to 15.6; $p = 0.05$), presence of protocol-defined referral to a dietician ($\beta = 10.5$, 2.9–18.0; $p < 0.01$), and use of the SNAQ screening tool (vs. MUST: $\beta = 9.1$, 1.7–16.6; $p = 0.02$).

Conclusion: Screening percentages have increased significantly since the introduction of the PI. Screening was more frequent in hospitals which have more patient admissions, protocol-defined referral to a dietician, and who use the SNAQ screening tool. This information may assist in improving Dutch screening rates and in implementation in other countries.

1. Introduction

Disease related undernutrition is a major problem in health care settings in Western Europe and other industrialized countries. The prevalence of undernutrition in hospitals is broadly described in the literature and ranges, depending on the definition used, from 10 to 60 percent.[1–10]

Undernutrition is found to be associated with reduced wound healing, increased complication rates, increased length of hospital stay, increased mortality, and increased health care costs.[2,6,11,12] Without screening, only half of the undernourished patients are recognized by medical and nursing staff,[13,14] which emphasizes the need for systematic screening.[15]

In 2007, through a collaboration between the Dutch Malnutrition Steering Group (DMG) and the Dutch Ministry of Health, Welfare and Sports, systematic screening for undernutrition in hospitalized patients was introduced as a performance indicator (PI) within the National Benchmarks on Quality of Care of the Dutch Health Care

Abbreviations: DMG, Dutch Malnutrition Steering Group; HCI, Health Care Inspectorate; MUST, Malnutrition Universal Screening Tool; PI, performance indicator; SNAQ, Short Nutritional Assessment Questionnaire.

☆ This work was presented during the Netherlands Society of Enteral and Parenteral Nutrition (NESPEN) session of the Dutch Society of Gastroenterology (NVGE) congress in April 2013.

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http://dx.doi.org/10.1016/j.clnu.2013.07.005

Inspectorate (HCI). Its introduction was guided by a DMG national implementation program. Annually, hospitals are required to report on a variety of care processes to the Dutch Health Care Inspectorate. Results are used to create transparency on quality of care and to rate the performance of Dutch hospitals. The PI on undernutrition screening obliges hospitals to annually provide information on the percentage of patients screened for undernutrition at hospital admission and on prevalence of undernutrition at admission.

Our data are among the first on systematic screening of undernutrition. While many countries are working on implementation programs, nationwide mandatory nutritional screening is still rare. Moreover, little is known about factors influencing screening results. Therefore the aim of this study is to evaluate the screening results from 2007 to 2010 and to identify predictive factors for achieved undernutrition screening results.

2. Methods

2.1. Hospitals

All 97 Dutch hospitals (58 general, 28 teaching, 8 university and 3 specialized hospitals) were required to provide data on undernutrition screening to the HCI. Between 2006 and 2009, 57 hospitals participated in the implementation program of the Dutch Malnutrition Steering Group "Early recognition and optimal treatment of malnutrition in Dutch hospitals". In 4–6 multidisciplinary workshops, led by an implementation expert and a scientific expert different steps of implementation and maintenance of screening and treatment were discussed. Moreover, a structured, multidisciplinary implementation plan was developed, and hospitals had the opportunity to share ideas. Additionally, a downloadable toolkit was developed, including implementation strategies, information material for all hospital disciplines, tools, guidelines, literature, ready to use factsheets and presentations, process evaluation forms, tools for data analysis, etc.[1] The other 40 hospitals implemented screening without participation in this project, but had access to all the material.

2.2. Performance indicator on undernutrition screening

The performance indicator on undernutrition screening requires that all patients $\geq$ 18 years need to be screened within 24 h after admission. Screening should be performed with a validated screening tool; either SNAQ (Short Nutritional Assessment Questionnaire)[16] or MUST (Malnutrition Universal Screening Tool).[17] A SNAQ score of 2 points or a MUST score of 1 point is defined as moderate undernutrition, and a SNAQ score $\geq$ 3 points or MUST score $\geq$ 2 points is defined as severe undernutrition. Patients are excluded for screening if they are admitted for less than 24 h or admitted to the maternity ward.[18]

The performance indicator consists of four components: the number of patients admitted to the hospital (for at least 24 h) in the year of report, the number of patients screened at admission (within 24 h) to hospital, the number of patients that were moderately undernourished, and the number of patients that were severely undernourished. The percentage of patients screened, and the percentages of moderately and severely undernourished patients were calculated from these numbers.

Hospitals are responsible for collecting their own data, and for reporting on the four components of the performance indicator to the HCI. Hospitals are required to provide this information on all (relevant) admissions in the year of report. Though, some hospitals provide only subsample information. Reasons for reporting subsample results are[1] screening is not implemented on all departments[2]; absence of electronic registration of undernutrition screening. Due to the time-consuming character of collecting screening information manually, these latter hospitals generally use four measurements throughout the year as a sample of all admissions, as the later introduced performance indicator on undernutrition treatment involves four measurements throughout the year as well,[18] or use the screening information collected in one or more months as a reflection of screening throughout the year.

Data on screening results from 2007 to 2010 were obtained directly from the Dutch Health Care Inspectorate.

2.3. Potential predictors

For this study, a questionnaire was developed to collect additional information about the hospitals. The questionnaire consisted of both closed and open ended questions, providing general hospital information and information on the implementation process. The questionnaire was tested in a pilot of 3 hospitals, including 2 general hospitals and 1 university hospital, after which minor adjustments were made. The final questionnaire was sent by email to all non-specialized hospitals, dieticians were asked to fill out and return the questionnaire. Eighty-one out of ninety-four hospitals (86%) responded to the additional questionnaire.

The following potential predictors of the obtained screening results of 2010 were investigated; hospital type (general, teaching, university, specialized), participation in the DMG implementation project (yes/no), used screening tool (SNAQ or MUST), screening information provided on all admissions or a subsample, protocol-defined referral to a dietician in case of undernutrition (yes/no), screening implemented in an electronic nursing record (yes/no), use of an electronic dietician record (yes/no), existence of a hospital-wide 'task force for undernutrition' (yes/no), presence of a 'task force for undernutrition' at each ward (yes/no), regular audit and feedback of screening results during the year (yes/no), target value recorded (yes/no), number of clinical admissions in 2010, number of clinical beds, number of clinical dieticians employed expressed in fulltime-equivalents (FTE) per 100 beds. The number of clinical admissions, clinical beds and FTE clinical dieticians per 100 beds were not normally distributed, and therefore divided into tertiles.

Specialized hospitals ($n = 3$; cancer, lung, and orthopedic) were excluded from prediction analyses, as these hospitals represent patient populations that are not comparable to the other hospitals and include mostly outpatient care.

2.4. Barriers and enablers

Within the questionnaire, two open ended questions were included on barriers and enablers for optimal screening. Dieticians were required to provide factors they believed were responsible for success or failure of screening in their hospital. Two researchers (EL, HK) scored the given answers into categories of enablers and barriers. Top 10 categories of enablers and barriers are presented. Moreover, dieticians were asked to rate the screening process in their own hospital on a 1–5 Likert scale. Scores were compared to achieved screening results.

2.5. Data analysis

Descriptive statistics were used to analyze the screening results of 2007–2010 and to summarize hospital characteristics. Means and standard deviations were calculated for continuous variables

[1] Dutch Malnutrition Steering Group: www.stuurgroepondervoeding.nl (Dutch)/ www.fightmalnutrition.eu (English).

and frequency distributions were calculated for categorical variables. Analyses were performed for all hospitals ($n = 97$) and complete cases reporting results in all years ($n = 75$). Differences in percentages between 2007 and other years were calculated with paired-samples *T*-tests ($n = 75$). Additionally, generalized estimated equations (GEE) method for longitudinal data analyses[19] was used to analyze changes in screening percentage over time.

Characteristics of hospitals who had responded to the questionnaire and hospitals who had not responded were compared by independent samples *T*-tests for continuous variables and Fisher-exact tests for categorical variables.

Univariate linear regression was used to investigate the association between possible predictors of successful screening and screening percentage in 2010 as the dependent variable. Multivariate linear regression, using backward selection, was used to create a model to identify predictive factors for better screening percentages including all hospitals reporting to the questionnaire. The explained variance of the prediction model was determined by R^2, reflecting the proportion of variance in the outcome explained by the predictors in the model.

A *p*-value of <0.05 was considered to be statistically significant for descriptive statistics and <0.10 was considered to be statistically significant for the linear regression analyses. Statistical analyses were performed using SPSS 20.0 for Windows (IBM Corporation, Armonk, NY, USA).

3. Results

3.1. Screening results

The number of hospitals that reported on the performance indicator on undernutrition screening to the Dutch Health Care Inspectorate increased from 75 in 2007 to 97 in 2010 (15 hospitals reported data on 3 years, 7 hospitals reported data on 2 years). Thereby the total number of patients reported on increased to more than one million (Table 1). The average number of patients reported on per hospital (mean ± SD) increased from 4577 ± 6635 in 2007 to 10,849 ± 8027 in 2010 (paired-samples *T*-test: $n = 75$; $p < 0.01$). The mean screening percentage increased significantly over the years, from 51 ± 28% in 2007 to 72 ± 17% in 2010 (GEE: $\beta = 7.2$; 95% CI 5.2–9.2; $p < 0.01$) (Fig. 1). While the absolute number of identified undernourished patients has increased over the years, the percentage of moderately and severely undernourished patients decreased from respectively 7 ± 5% and 18 ± 11% in 2007 to 5 ± 4% and 15 ± 6% in 2010 (paired-samples *T*-test: $n = 75$; $p < 0.01$).

In 2010, 63 hospitals (65%) reported screening data on all hospital admissions, while 34 hospitals (35%) reported data on a subsample of admissions. The screening percentage of hospitals who took a subsample was not different from hospitals reporting data on all admissions (71 ± 16% vs. 74 ± 18%; $p = 0.32$). Though, the prevalence of patients identified as severely undernourished was significantly higher in hospitals presenting subsample data (19 ± 8% vs. 13 ± 5%; $p < 0.01$).

Specialized hospitals ($n = 3$; resp. a cancer, lung, and orthopedic center) did not report data on all years, and reported significantly lower screening results, than did the other hospitals (2010: 48 ± 31% vs. 73 ± 16%; independent samples *T*-test: $p = 0.01$). As described in the method section, these hospitals were excluded from regression analyses.

3.2. Predictive factors for screening results

Eighty-one hospitals (86%) completed the additional questionnaire. There were no statistically significant differences between characteristics of respondents compared to non-respondents with regard to screening percentage (2010: 73 ± 14% vs. 71 ± 25%; $p = 0.76$), hospital size (10,716 ± 7850 vs. 13,070 ± 9419; $p = 0.33$), hospital type (general, teaching, university: 62%, 30%, 9% vs. 62%, 31%, 8%; $p = 0.99$) used screening tool (SNAQ/MUST: 81/19% vs. 77/23%; $p = 0.71$) and participation in the implementation program (60% vs. 54%; $p = 0.77$).

Factors associated with the screening results reported in 2010 are shown in Table 2. Screening results were higher for hospitals that had participated in the DMG implementation program, compared to hospitals who had implemented screening without participation in the program. Year of participation in the DMG

Table 1
Screening results 2007–2010 based on the performance indicator on undernutrition screening reported by Dutch hospitals to the Dutch Health Care Inspectorate.

	2007	2008	2009	2010
n Hospitals	75	91	94	97
n Patients admitted to hospital	343,241	793,901	883,065	1,052,347
Mean ± SD per hospital	4577 ± 6635	8629 ± 8446	9295 ± 7935	10,849 ± 8027
Min–max	80–27,725	46–37,914	79–37,546	81–38,294
Paired-samples *T*-test [a]	–	<0.01	<0.01	<0.01
n Patients screened at admission	145,418	387,714	533,792	774,113
Mean ± SD per hospital	1939 ± 4102	4214 ± 4809	5679 ± 5280	7891 ± 6538
Min–max	33–21,824	22–20,787	46–22,173	43–33,373
Paired-samples *T*-test [a]	–	<0.01	<0.01	<0.01
% Patients screened (mean ± SD)	51.3 ± 27.9	55.6 ± 25.4	64.5 ± 22.1	72.1 ± 16.8
Min–max	(0.4–100.0)	(3.4–100.0)	(3.7–100.0)	(16.4–100.0)
Paired-samples *T*-test [a]	–	0.08	<0.01	<0.01
% Moderate undernutrition (mean ± SD)[b]	7.0 ± 5.3	6.0 ± 4.8	5.8 ± 4.4	5.1 ± 3.5
Min–max	(0.5–26.3)	(0.0–28.3)	(0–24.3)	(0–21.2)
Paired-samples *T*-test [a]	–	<0.01	0.07	0.02
% Severe undernutrition (mean ± SD)[c]	18.3 ± 10.8	17.4 ± 8.3	16.2 ± 7.5	15.1 ± 7.1
Min–max	(0.5–65.1)	(0.0–46.0)	(1.1–35.4)	(1.7–37.2)
Paired-samples *T*-test [a]	–	0.57	0.05	<0.01

[a] Paired-samples *T*-test compared to 2007 ($n = 75$).
[b] Number of hospitals reporting on (%) moderate undernutrition: 2007 $n = 66$, 2008 $n = 90$, 2009 $n = 93$, 2010 $n = 97$.
[c] Number of hospitals reporting on (%) severe undernutrition: 2007 $n = 65$, 2008 $n = 90$, 2009 $n = 93$, 2010 $n = 97$.

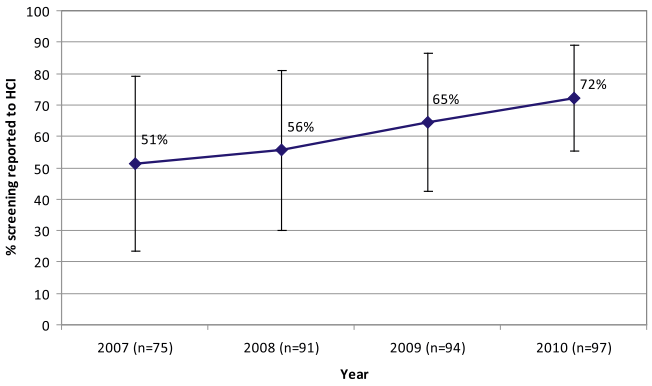

Fig. 1. Screening results (%) in Dutch hospitals reported to the Dutch Health Care Inspectorate between 2007 and 2010.

implementation program showed no significant association with achieved screening results. Hospitals using the SNAQ undernutrition screening tool reported better screening results compared to hospitals using MUST.

Additionally, hospitals with agreements on protocol-defined referral to a dietician in case of undernutrition reported a higher screening percentage compared to hospitals without these protocols. Moreover, a higher number of clinical admissions and a higher number of clinical beds were both positively and significantly associated with screening percentage, with highest screening results for the largest hospitals (>22,000 admissions or ≥600 beds).

Multivariate linear regression analysis, using backward selection, provided a set of predictive factors for the obtained screening results (Table 3). Positive predictive factors were; being a large hospital, with >22,000 clinical admissions per year (β = 14.0, 95%

Table 2
Univariate predictors of screening results in 2010.

		N (%)	β[a]	95% CI
General information (*n* = 94)				
Hospital type	General hospitals[b]	58 (62)	–	–
	Teaching hospitals	28 (30)	5.1	−2.1; 12.2
	University hospitals	8 (9)	−8.0	−19.7; 3.7
Participation in DMG implementation program	Yes	56 (60)	6.4	−0.2; 12.9**
	No[b]	38 (40)	–	–
Year of participation in DMG implementation program (*n* = 56)	2006[b]	6 (11)	–	–
	2007	29 (52)	−5.7	−17.4; 6.1
	2008	15 (27)	−7.5	−20.2; 5.1
	2009	6 (11)	7.6	−7.5; 22.7
Information provided by HCI (*n* = 94)				
Undernutrition screening tool	SNAQ	76 (81)	7.0	−1.1; 15.2**
	MUST[b]	18 (19)	–	–
Year of first report on screening indicator to HCI	2007[b]	75 (79)	–	–
	2008	15 (16)	−4.0	−12.9; 5.0
	2009	4 (4)	−4.5	−20.7; 11.8
Type of measurement 2010	All admissions	60 (64)	−2.5	−9.2; 4.3
	Subsample[b]	34 (36)	–	–
Questionnaire (*n* = 81)				
Protocol-defined referral to a dietician	Yes	68 (84)	10.5	2.3; 16.7*
	No[b]	13 (16)	–	–
Screening incorporated in electronic nursing record	Yes	27 (33)	−2.4	−9.0; 4.2
	No[b]	54 (67)	–	–
Electronic dietician record	Yes	24 (30)	0.3	−6.5; 7.2
	No[b]	57 (70)	–	–
Hospital-wide task force	Yes	40 (49)	−0.9	−7.1; 5.4
	No[b]	41 (51)	–	–
Task force on each ward	Yes	27 (33)	−3.3	−9.9; 3.3
	No[b]	54 (67)	–	–
Evaluation of screening percentage during the year	Yes	68 (84)	5.6	−2.8; 14.0
	No[b]	13 (16)	–	–
Target value recorded	Yes	48 (59)	1.1	−5.3; 7.4
	No[b]	33 (41)	–	–
Number of clinical admissions in 2010[c]	Low (<12,500)[b]	23 (28)	–	–
	Middle (12,500–22,000)	26 (32)	7.1	−0.6; 14.8**
	High (>22,000)	25 (31)	11.9	4.2; 19.7*
	Missing	7 (9)	6.3	−5.3; 17.9
Number of clinical beds in 2010[d]	Low (≤300)[b]	24 (30)	–	–
	Middle (301–599)	28 (35)	6.4	−1.4; 14.1
	High (≥600)	27 (33)	8.4	0.8; 16.1*
FTE clinical dieticians (per 100 clinical beds)	Low (<0.8)[b]	21 (26)	–	–
	Middle (0.8–1.2)	29 (36)	−0.2	−8.4; 7.9
	High (>1.2)	22 (27)	2.0	−6.7; 10.6
	Missing	9 (11)	−0.8	−12.1; 10.6

*$P < 0.05$; **$P < 0.10$.
DMG = Dutch Malnutrition Steering Group; HCI = Health Care Inspectorate.
[a] β = Regression coefficient.
[b] Reference category.
[c] Number of clinical admissions according to the questionnaire.
[d] 2 Missing values (*n* = 79).

Table 3
Multivariate predictors of screening results in 2010 ($n = 81$).

		N (%)	β[a]	95% CI	*p*-Value
Constant			49.6	32.3; 60.0	
Number of clinical admissions in 2010	Low (<12,500)[b]	23 (28)	–	–	
	Middle (12,500–22,000)	26 (32)	7.3	−0.8; 15.6	0.05
	High (>22,000)	25 (31)	14.0	3.9; 20.5	<0.01
	Missing	7 (9)	7.9	−3.0; 18.7	0.15
Protocol-defined referral to a dietician	Yes	68 (84)	10.5	2.9; 18.0	<0.01
	No[b]	13 (16)	–	–	
Undernutrition screening tool	SNAQ	66 (82)	9.1	1.7; 16.6	0.02
	MUST[b]	15 (19)	–	–	

[a] β = Regression coefficient.
[b] Reference category.

CI: 3.9–20.5, $p < 0.01$) or 12,500–22,000 admissions per year ($\beta = 7.9$, 95% CI: −0.8 to 15.6, $p = 0.05$), having a protocol-defined referral to a dietician in case of undernutrition ($\beta = 10.1$, 95% CI: 2.4–17.8; $p = 0.01$), screening with SNAQ ($\beta = 9.5$, 95% CI: 1.8–14.7; $p = 0.02$). The proportion of variance in outcome explained by the predictors in the model (R^2) was 0.25.

3.3. Subjectively reported barriers and enablers

Self-rating of screening by dieticians (Likert scale 1–5) was strongly related to screening results ($\beta = 5.5$; 95% CI: 2.4–8.5; $p < 0.01$). Most reported enablers for successful screening were engagement of nurses and specialists, screening as an obligated item in (electronic) patient record, and continuous motivation and education by dieticians. Most reported barriers were high workload, absence of engagement/support of nurses and specialists, and absence of clear multidisciplinary responsibility (Table 4).

4. Discussion

Our data are among the first on nationwide mandatory systematic screening of undernutrition in hospitals, and therefore present unique information, based on data of all Dutch hospitals with more than 1 million admissions per year. The percentage of patients screened within 24 h after hospital admission increased significantly over the years 2007–2010, from 51 to 72%, whereas the percentage of patients identified as severely undernourished decreased from 18 to 15%.

This study also gives insight into factors associated with higher reported screening percentage: a higher number of clinical admissions, having agreements on protocol-defined referral to a dietician in case of undernutrition and screening with SNAQ.

Hospitals with more clinical admissions reported 7–14% higher screening percentages compared to hospitals with the least clinical admissions. It is suggested that smaller hospitals have less clinical dieticians employed. Continuous motivation and education by dieticians was reported by one third of the respondents as an enabler for successful screening. We expect that larger teams of clinical dieticians have more possibilities and resources to motivate and educate care workers. Moreover, larger hospitals might be involved in other implementation projects, and have better policy on implementation strategies.

Hospitals with protocol-defined referral reported an 11% higher screening percentage than hospitals without protocol-defined referral. Screening for undernutrition is generally carried out by nurses. If referral to a dietician is defined by protocol, the nurse is allowed to refer the undernourished patient to the dietician, without interference of a physician, and treatment can be started at an earlier stage. Although screening takes place before the referral, a protocol-defined referral may reflect a good structure around undernutrition, where agreements are made on early recognition and optimal treatment of the undernourished patient. A study of the Scandinavian Nutrition Group demonstrated that when there were more guidelines for parenteral and enteral nutrition in hospitals, there was a positive change toward implementation of good nutrition standards.[20] Thus, it is likely that by shifting these responsibilities from physicians to nursing staff, nurses will become more involved in the process of treatment, which may result in more engagement, and thereby a better screening result. Lack of engagement of nursing staff was also addressed as a barrier for successful screening by one third of the dieticians.

Type of screening tool was associated with percentage patients screened. Hospitals screening for undernutrition with SNAQ reported a 9% higher mean screening percentage than hospitals screening with MUST. SNAQ is a quick-and-easy method whereas MUST involves calculation of BMI (kg/m^2) and percentage weight loss. Van Venrooij et al., in an earlier study, also suggested that the calculation of percentage weight loss or BMI are too time consuming for routine use in clinical practice.[21] Another study comparing undernutrition screening tools showed that SNAQ provided more complete data than MUST.[22] These studies support our finding that a quick-and-easy screening tool may enhance screening in a clinical setting.

Approximately one-quarter of the observed variance in the 2010 screening rates could be explained for by the combination of the number of clinical admissions, protocol-defined referral to a dietician, and the used screening tool. Other variance might be explained by factors such as lack of nutritional knowledge, interest and education of health care workers, lack of clearly defined responsibilities of planning and managing nutritional care, and the high workload of nurses, which have been extensively studied by the Scandinavian Nutrition Group.[4,20,23–25] This is supported by the results of the collected data on enablers and barriers for optimal screening. Most reported barriers were high workload (34%), lack of engagement of nurses and specialists (27%), and lack of clear multidisciplinary responsibilities (23%). These factors should be addressed in order to improve both nutritional screening and treatment in hospitalized patients.

Table 4
Subjectively reported enablers and barriers for optimal screening by dieticians ($n = 81$).

	Enablers	*n* (%)[a]
1	Engagement of nurses/specialists	28 (36%)
2	Screening as a required item in (electronic) record	27 (35%)
3	Continuous motivation and education by dieticians	27 (35%)
4	Clear multidisciplinary responsibility	21 (27%)
5	Coordination by hospital management	18 (23%)
6	Frequent feedback and support of screening results	15 (19%)
7	Simple quick-and-easy screening	6 (8%)
8	Obligating character of the performance indicator	6 (8%)
9	Well structured task force on each ward	4 (5%)
10	Sufficient resources (computers, ICT support)	3 (4%)
	Barriers	***n* (%)[b]**
1	High workload	25 (34%)
2	Lack of engagement of nurses/specialists	20 (27%)
3	Lack of clear multidisciplinary responsibility	17 (23%)
4	Absence of good ICT support or (non-optimal) electronic patient record	15 (21%)
5	Insufficient coordination by hospital management	11 (15%)
6	Screening too time consuming	10 (14%)
7	Communication problems, insufficient education	10 (14%)
8	Prevalence related factors (short admissions, low prevalence of undernutrition in certain wards)	10 (14%)
9	Organizational restructuring	6 (8%)
10	Absence of good feedback of screening results	5 (7%)

[a] $n = 78$; 3 Dieticians reported no enablers for optimal screening.
[b] $n = 73$; 8 Dieticians reported no barriers for optimal screening.

The hospital data of 2010 showed that 15% of the screened patients were identified as severely undernourished. This is in line with studies done in Western Europe regarding the prevalence of undernutrition.[3,4,6,10,26] Over the years, the data showed a decline in the reported prevalence of undernutrition. Meijers et al. also described a decline in prevalence of undernutrition in hospitals involved in the annual LPZ measurement between 2004 and 2007 especially in those hospitals involved in the measurement more often.[27] Furthermore, O'Flynn et al. demonstrated that the prevalence of hospital undernutrition declined from 24% in 1998 to 19% in 2004 in 3 consecutive studies as a result of implementation of nutritional strategies and nutritional screening.[28] Both studies address the effect of increased knowledge and awareness of undernutrition in medical staff. This also thoroughly applies to our results, showing that hospitals involved in our carefully supervised nationwide 1-year implementation program for screening and treatment of undernutrition in hospitalized patients report higher levels of screening. Moreover, we believe that with increasing attention for undernutrition in the clinical setting, awareness of this problem in the hospital outpatient setting increased as well. In fact, during this study period, several hospitals implemented undernutrition screening in some of their outpatient departments. Recognition and treatment of undernourished patients in the outpatient setting, may contribute to a higher number of patients in a better nutritional status at hospital admission, or hospital admissions may even be postponed or prevented. Due to declining length of hospital stay, a shift toward outpatient screening is inevitable. As of 2013, undernutrition screening in the preoperative outpatient department is advised by the HCI.[18]

A major strength of our data is the magnitude of the sample size. Due to the mandatory character of the PI, all Dutch hospitals are involved, so results could not have been biased because only the most motivated hospitals have participated. Furthermore, the response rate to the questionnaire was high (86%) and no differences were observed between respondents and non-respondents. The reported data include over hundred thousands of patients per year, and even more than one million patients in 2010. However, data on screening is collected at hospital-level, not at patient-level. Out of the 1,052,347 newly admitted patients in 2010, 774,113 patients were screened on admission. This means that 73.6% of the total of admitted patients to all hospitals were screened within 24 h after admission, while the average screening percentage per hospitals is 72.1%. A recommendation for further research is to assess predictive factors for successful screening results on patient-level, so that patient-related factors can be included.

A limitation of the study is the fact that hospitals were responsible for reporting screening data themselves. As a result, both overestimation (4 hospitals reported a screening percentage of 100% in 2010) and underestimation (2 hospitals reported below 20% screening in 2010) are expected.

Another disadvantage of the data collected by hospitals is that, while hospitals are obliged to report on all admitted patients, one third of hospitals reported only subsample results. In the first years, subsample results represented data on a selection of departments, as in most hospitals undernutrition screening was not implemented throughout all departments. Since most hospitals started to screen in the patients groups most vulnerable for undernutrition, these data are likely to represent the departments with a higher risk of undernutrition. In 2010, subsample results were mostly based on four measurements throughout the year, and are more likely to be a proper indication of screening in all departments. The reported screening percentage for those hospitals was not significantly different from hospitals reporting on all admissions. Though, the reported prevalence of severe undernutrition was significantly higher in hospitals reporting subsample results, still suggesting that more high-risk departments were involved in the measurements. This could have biased the reported decrease in prevalence of undernutrition. Hospitals increasingly introduce electronic patient records, so collecting data on screening of hospitalized patients will be easier. Future measurements are therefore expected to be more complete and accurate.

5. Conclusion

The Dutch approach to undernutrition is unique. Hospitals are required to report on the performance indicator on undernutrition screening, and these data are monitored by the Dutch Health Care Inspectorate. This mandatory screening guided by a national implementation program, seems to be a successful approach to increase screening and decrease undernutrition prevalence rates. Higher screening results are associated with total number of clinical admissions, the availability of a protocol-defined referral and the type of screening tool used. Based on these results, we advise hospitals to use a quick-and-easy screening tool for undernutrition screening, and to embed undernutrition screening in a structured, multidisciplinary implementation plan, including protocol-defined referral. This information is crucial to further improve Dutch screening results, and may be valuable for implementation of undernutrition screening in other countries.

Statement of authorship

EL and HK designed the study. EL performed part of the data collection, performed the data analyses, and wrote the manuscript. AH participated in most of the data collection and writing the manuscript. MB, MV, JL, and HK participated in the design of the study and reviewed the manuscript. All authors read and approved the final manuscript.

Sources of funding

No external funding was obtained to perform this study.

Conflict of interest

None.

Acknowledgments

The authors thank all the Dutch hospitals for reporting data to the Health Care Inspectorate, as well as the Dutch Health Care Inspectorate – with special regard to Sytske de Jong and Jan Maarten van den Berg – for providing the screening data. Moreover, we gratefully acknowledge the dieticians for responding to the questionnaire.

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