



National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Point-of-care testing in nursing homes in the Netherlands

Management of patient safety related
aspects

RIVM Report 2014-0060/2014

L.W.M. van Kerkhof et al.



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Colophon

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Abstract

Point-of-care testing in nursing homes in the Netherlands

Management of patient safety-related aspects

Point-of-care (POC) tests are used near patients in order to make a fast diagnosis. A well-known example of a POC test is the blood glucose meter, which can measure the blood sugar levels of a diabetic patient. POC tests are increasingly being used in nursing homes. In order to be able to make a correct diagnosis, the appropriate use of the tests is important. Results of the explorative study conducted by the RIVM show that many quality and safety aspects related to the use of POC tests are well-managed in most of the nursing homes. Yet for some aspects there is insufficient attention.

Results

In most of the nursing homes, hygienic measures are implemented. Aspects such as patient identification, the maintenance of POC test meters and the handling of samples are managed well in most of the nursing homes. The training of users, followed by refresher courses, however, is less well-organised. Moreover, only a few of the nursing homes had protocols or manuals for POC tests or took the appropriate control measures upon receiving the test materials or just before the POC test was actually used. Almost a quarter of the nursing homes reported that they did not have a person who bears final responsibility for the use of POC tests.

Recommendations

In order to further improve the quality of care provided and to reduce the risk of POC testing being used incorrectly in nursing homes, it is recommended that periodic training and refresher courses be organized and that participation be registered. Moreover, it is important to develop protocols or manuals for the use of POC tests. Further control measures performed when test materials are received and during the pre-analytical phase are recommended. In addition, it is recommended that an employee be designated to bear final responsibility for the use of POC tests.

Keywords: point-of-care tests, nursing homes, patient safety, blood glucose test, nitrite test, INR-PT test.

Publiekssamenvatting

Point-of-care testen in verpleeg- en verzorgingshuizen in Nederland Beheer van patiëntveiligheidsaspecten

Point-of-care (POC-) testen worden in de nabijheid van patiënten gebruikt om snel een diagnose te stellen. Een bekend voorbeeld is de bloedglucosemeter waarmee de bloedsuikerwaarde van een diabetespatiënt kan worden gemeten. POC-testen worden steeds meer gebruikt in verpleeg- en verzorgingshuizen. Om een juiste diagnose te kunnen stellen is het van belang dat de testen adequaat worden gebruikt. Uit verkennend onderzoek van het RIVM blijkt dat veel specifieke kwaliteits- en veiligheidsaspecten gerelateerd aan het gebruik van POC-testen in de meeste verpleeg- en verzorgingshuizen wel goed zijn geregeld, maar dat voor enkele aspecten nog onvoldoende aandacht is.

Bevindingen

In de meeste verpleeg- en verzorgingshuizen wordt aandacht besteed aan hygiëne, patiëntidentificatie, onderhoud van POC-meters en omgang met bloed- of urinemonsters. Onvoldoende aandacht is er voor trainingen en opfriscursussen voor het gebruik van POC-testen. Tevens wordt er niet in alle huizen gebruik gemaakt van protocollen of handleidingen of worden kwaliteitscontroles uitgevoerd bij ontvangst van testmaterialen en vlak voordat ze worden gebruikt. Bijna een kwart van de verpleeghuizen heeft aangegeven geen eindverantwoordelijke voor het gebruik van een POC-test te hebben aangewezen.

Aanbevelingen

Om de kwaliteit van zorg verder te verbeteren en risico's op gebruiksfouten met POC-testen in verpleeg- en verzorgingshuizen te verminderen, is het aan te bevelen om een eindverantwoordelijke persoon aan te wijzen voor het beheer en gebruik van POC-testen. Vervolgens is het aan te bevelen om periodiek trainingen en opfriscursussen te organiseren en deelname te registreren. Daarnaast is het van belang protocollen of handleidingen op te stellen voor het gebruik van POC-testen. Ook zijn kwaliteitscontroles gewenst bij ontvangst van testmaterialen en vlak voordat ze worden gebruikt.

Trefwoorden: point-of-care (POC-) testen, verpleeg- en verzorgingshuizen, patiëntveiligheid, bloedglucosetest, nitrietest, INR-PT test.

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Summary

Point-of-care (POC) diagnostic tests are used by health care professionals to make a clinical diagnosis near the patient. POC diagnostic tests provide test results quickly and may prevent referrals, which is convenient for patients and enhances efficiency. However, POC tests are used by various health care professionals, often without laboratory experience, and in a variety of settings. In order to be able to make a correct diagnosis, the appropriate use of the tests is important. The quality and safety aspects related to the use of POC tests must therefore be managed accordingly.

The Dutch Health Care Inspectorate (IGZ) supervises the safe introduction, management and use of health care technology. POC diagnostic tests are increasingly used in health care organisations in the Netherlands, such as nursing homes. IGZ has commissioned the National Institute for Public Health and the Environment (RIVM) to study the use of these products. The aim of this explorative study is to investigate how patient safety aspects related to the use of POC tests by health care professionals in nursing homes are managed in the Netherlands. To our knowledge, this is the first study to investigate the use of POC tests in Dutch nursing homes.

A questionnaire was sent to 959 unique email addresses of nursing homes taken from the 'KiesBeter' database. Several addresses were excluded, leaving 866 addresses in the study of which 310 respondents completed the questionnaire (36%).

The results indicate that the use of POC tests in nursing homes is indeed widespread, with 87% of respondents using one or more types of POC test. Blood glucose tests and nitrite tests are used by almost all respondents (99% and 82%, respectively). International Normalized Ratio Prothrombin Time (INR-PT) tests for anticoagulation therapy management are used by 24 per cent of the respondents. POC tests are used on a frequent basis (daily or weekly).

Several key elements related to patient safety have been investigated in the present study. The majority of the respondents had implemented measures related to patient identification, hygienic measures (such as washing hands), the maintenance of meters and handling samples. Conflicts between test results and symptoms, or results being out of range, were generally classified as occurring 'sometimes' (several times a year). In general, adequate actions were taken when such events occurred. Only a few respondents contacted the manufacturers.

Providing training and refresher courses is an important quality management aspect. However, the nursing homes in this study indicated that one-third of the users of glucose and INR PT tests did not provide training. Approximately half of them did not provide refresher courses. For nitrite tests, the numbers were even higher.

In summary, POC tests are used frequently in a majority of nursing homes and the use of glucose tests and nitrite tests is the most widespread. Most key elements of patient safety were reported to be managed well by the majority of nursing homes, but shortcomings are observed with respect to providing training and refresher courses, the availability of protocols, and the organisation of responsibility for the use of POC tests.

Abbreviations

ECS	Elderly care specialist
GPs	General practitioners
INR PT	international normalized ratio prothrombin time
IGZ	the Health Care Inspectorate of the Netherlands
POC	point-of-care
POCT	point-of-care testing
RIVM	National Institute for Public Health and the Environment
ZZP	Zorg zwaarte pakket (indication for the extent of care a patient needs)

1 Introduction

1.1 Background

With point-of-care (POC) diagnostic tests, health care professionals can make a clinical decision near the patient. Using POC diagnostic tests leads to the quick availability of test results and subsequent therapeutic decision-making and may prevent referrals to secondary care, which is convenient for patients and enhances efficiency. But POC tests are used by various health care professionals, often without laboratory experience, and in a variety of settings. The organisation of the requirements to perform the tests correctly and the caution to be taken when interpreting test results, therefore, need to be managed accordingly.

In the literature, several key elements have been described for managing the patient safety aspects related to POC testing (Textbox 1).

Textbox 1

Key elements for managing POC testing-related patient safety aspects [1-4]:

- Users must be trained in using the POC diagnostic test.
- Users must have experience with the test.
- Quality control measures are necessary: when receiving the test materials, before using the test, when the test is performed, and with respect to periodical maintenance and calibration.
- The results must be listed in a registration system.
- When a test result conflicts with the observed clinical symptoms, or when the professional does not trust the test result, alternative actions have to be considered, e.g. repeating the test or sending a sample to a laboratory for testing.

Source: Point-of-care testing in primary care in the Netherlands (de Vries et al 2012 [5]).

In Dutch hospitals, health care professionals manage most of these key elements well, as shown in a study by Roszek et al [6]. Results from another study show that not all key elements appear to be managed well at Dutch general practitioner practices [5]. POC tests are also used frequently in nursing homes, where typically a variety of health care professionals work, all of whom have their own field of expertise (Appendix 3). Therefore, the question of how these key elements are managed within nursing homes was raised. The Health Care Inspectorate (IGZ) of the Netherlands supervises the safe introduction, management and use of health care technology. IGZ commissioned the National Institute for Public Health and the Environment (RIVM) to study the use of POC tests in nursing homes.

1.2 Aim

The aim of this explorative study is to investigate how patient safety¹ aspects related to the use of POC tests by health care professionals in nursing homes are managed in the Netherlands.

¹In the Netherlands, residents of nursing homes are called clients. However, the term patient safety is internationally well known, whereas client safety is not. Therefore, we use the term patient and patient safety throughout this report.

2 Method

2.1 Questionnaire

A web-based questionnaire was developed to obtain information on the management of patient safety aspects in nursing homes in the Netherlands. The questionnaire was based on a literature search, a pilot study in five nursing homes, a questionnaire used in our previous study regarding POC tests in primary care [2], and input from experts on nursing homes and anticoagulation therapy management. The pilot study showed that the following POC tests were used most frequently: blood glucose tests (diabetes), nitrite tests (urinary tract infections), and international normalized ratio prothrombin time (INR PT) tests (anticoagulation therapy management). The literature search and the questionnaire, therefore, focused on these three tests. The literature search was performed using Scopus (Elsevier) and PubMed (US National Library of Medicine). Search strings used included "point of care testing", "blood glucose test", "nitrite test", "INR PT test", "nursing home", "long term care", "elderly care".

The questionnaire consisted of four parts, i.e. general information, the use of blood glucose tests, nitrite tests and INR PT tests. The latter three parts only had to be completed by respondents that indicated they used the specific tests. All questions were closed-ended. In several cases, multiple answers could be given, which was always indicated. The questionnaire was developed using the software application QuestBack (Oslo, Norway). Important aspects included in the questionnaire were the training of users, the receipt and storage of test materials, the calibration and maintenance of equipment, hygienic measures, actions following test results, and attention for quality and safety aspects during the pre-analytical, analytical and post-analytical phase. The complete questionnaire (in Dutch) is presented in Appendix 1. Respondents had to answer each question before being allowed to continue.

2.2 Study population, data collection and data analyses

In December 2012, there were 2,153 nursing homes in the Netherlands [7]. To obtain contact information for nursing homes, the 'KiesBeter' database was used [8]. The aim of this database is to provide the public with an overview of available health care organizations and their quality. All types of health care organisations can provide their own details to this database. From this database, nursing homes were selected that stated they provided inpatient elderly care and had provided an e-mail address for contact (n=1922). Approximately half of the nursing homes are part of one and the same organisation and therefore provided the same e-mail address. In the selection, 959 unique e-mail addresses were identified and included in this study.

To announce the study, IGZ sent a letter by e-mail to the organisations requesting their participation. Of the 959 addresses, 68 addresses were excluded because the e-mail could not be delivered to the provided address. A second letter, which provided the link to the web-based questionnaire, was sent to the remaining 891 e-mail addresses by RIVM. Both letters provided information regarding the aim and content of the study, as well as regarding the following specifications:

- 1) only nursing homes² were included;
- 2) the study included only POC tests used by health care professionals, not tests used by patients;
- 3) the study included only POC test equipment and materials that are owned by the organisation or by an associated clinical laboratory;
- 4) the questionnaire should be completed by the person responsible for POC testing in the organisation.

To maximize the response rate, two reminders were sent: after 3 weeks and after 7 weeks. The letters (in Dutch) from IGZ and RIVM, including the reminders, are included in Appendix 2. Data was analysed using SPSS statistical software (version 19, IBM software). Frequencies were calculated per question. Percentages below 10% were rounded off by 1 decimal for informative purposes, and do not reflect differences in precision.

² Organisations that combine nursing homes with home care activities should only indicate the situation in the nursing home(s)

3 Results

3.1 Characteristics of the respondents

The invitation was sent to 891 e-mail addresses. Nineteen e-mail addresses were excluded because the respondents indicated that another e-mail address (in the 'KiesBeter' database) had already been used to submit the questionnaire for their organisation. In addition, five e-mail addresses were excluded because the respondents indicated that they only provided outpatient care and one e-mail address was removed because the respondent indicated that the nursing home was no longer operational. Of the 866 possible respondents, 310 completed the questionnaire (36%). Ten respondents were excluded because the questionnaire had been filled out inconsistently, i.e. filling in answers for specific tests, while indicating that they did not use the test. Of the 300 questionnaires included, 57% were completed for 1 location, the rest for multiple locations (Table 1). Of the organisations with multiple locations, only 5.6% stated that there were differences in the use of POC tests between the locations.

The majority of the respondents represented nursing homes that provide care in ZZP category 5-10, i.e. patients requiring intensive care (see Appendix 3),. Most of the questionnaires were completed by managers, followed by general practitioners (GP)/elderly care specialists and nurses. The characteristics of the respondents are summarized in Table 1.

Table 1 Characteristics of nursing homes and respondents (n = 300)

Demographic variables		n	%
Location/ organisation	One location	172	57
	Organisation (> 1 location) without differences in POC test use between locations	111	37
	Organisation with differences in POC test use between locations	17	5.6
Type of care (ZZP categories)	Mainly ZZP 1-4	54	18
	Mainly ZZP 5-10	157	52
	All, ZZP 1-10	89	30
Responding type of health care professional	Management	135	45
	GPs/elderly care specialist	61	20
	Nurse	48	16
	Nurse practitioner	24	8.0
	Other	23	7.6
	Nurse assistant	9	3.0

3.2 Use of POCT in nursing homes and responsibilities

Eighty-seven per cent (260 out of 300) of the respondents indicated that they use POC tests.

Most of these respondents use the blood glucose test and/or the nitrite test for urinary tract infections. Other tests, such as the INR-PT, dipslide (alternative test for urinary tract infections) and D-dimer (for thrombosis) are used by fewer respondents (see Table 2). If glucose, nitrite and INR-PT tests are used, they are used frequently, i.e. daily or weekly (see Figure 1).

Table 2 Use of POC tests in nursing homes (n=260)

Types of test used*	n	%
Glucose	257	99
Nitrite	213	82
INR-PT	62	24
Dipslide	44	17
D-dimer	21	8.0
Other	16	6.1

*Respondents could choose more than one answer.

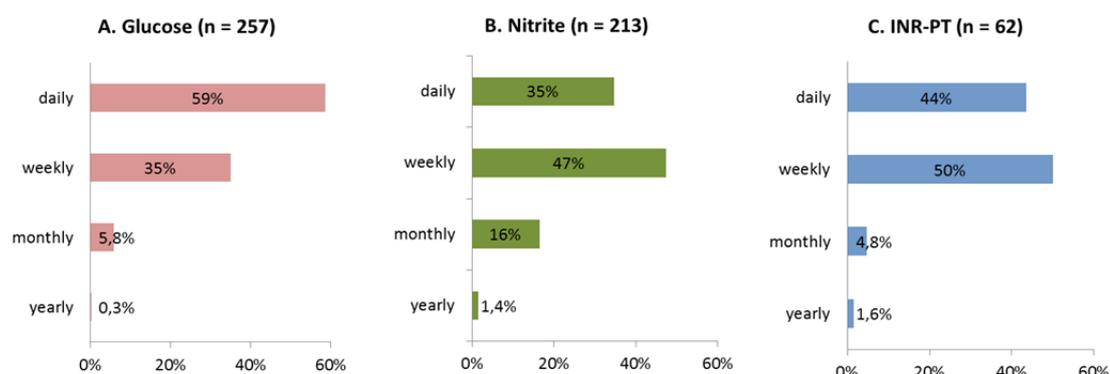


Figure 1. Frequency of use for glucose (panel A), nitrite (panel B), and INR-PT tests (panel C).

Respondents that reported the use of nitrite, glucose and/or INR-PT tests were asked which type of health care professionals would perform these tests. For nitrite tests and glucose tests, these were mainly nurse assistants (85% and 96%, respectively) and nurses (83% and 88%, respectively). For INR-PT tests, the majority of users were nurses (61%) and experts from an anti-coagulation service³ (31%). In a few nursing homes, the nitrite and glucose tests were performed by care assistants (1.8% and 1.9%). For a complete overview of the type of health care professionals performing nitrite, glucose and INR-PT tests, see Figure 2.

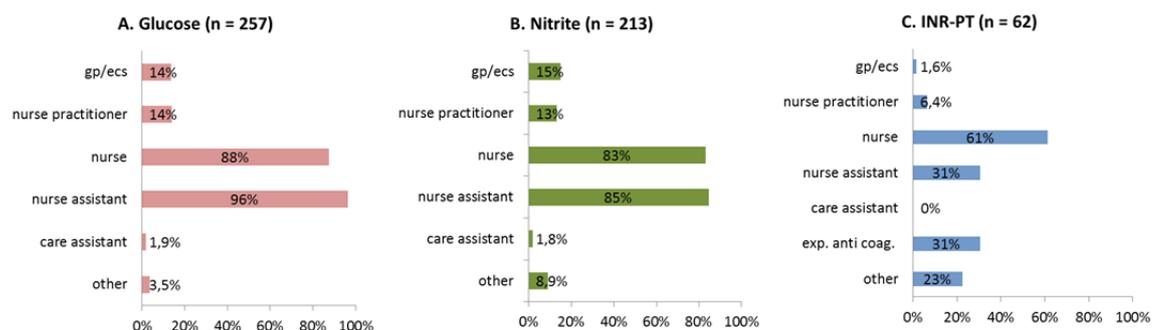


Figure 2. Users of POC tests by type of health care professional for glucose (panel A), nitrite (panel B) and INR-PT tests (panel C). Respondents could choose more than one answer. gp – general practitioner, ecs – elderly care specialist

³ Anti-coagulation service is also known as thrombosis service.

Of the respondents using POC tests, 44% (115 out of 260) indicated they worked with one or more specialist organisations, such as a clinical chemical laboratory (15%), anti-coagulation service (24%) and other organisation (22%).

3.2.1

Interpretation of the tests

Respondents were also asked which type of health care professionals would interpret the results of the POC tests (more than one answer possible). The results of glucose tests are most often interpreted by GPs/elderly care specialists (91%) or nurses (61%). Nurse assistants interpret glucose tests in 45% of the respondents' nursing homes. Four respondents (2 management, 1 nurse practitioner and 1 other) indicated that only nurse assistants interpreted the blood glucose test results.

The results of nitrite tests were interpreted most often by GPs/elderly care specialist (94%) or nurses (43%). In some nursing homes, nitrite test results were also interpreted by nurse assistants (25%) or, although rarely, by care assistants (1.4%). Similar to blood glucose test results, the same four respondents indicated that only nurse assistants interpreted the glucose test results.

The results of INR-PT tests are most often interpreted by experts from an anti-coagulation service (69%) or GPs/elderly care specialists (47%). None of the respondents indicated that nurse assistants or care assistants interpret the results of INR tests. For a complete overview of the results regarding the interpretation of test results per type of health care professional, see Figure 3.

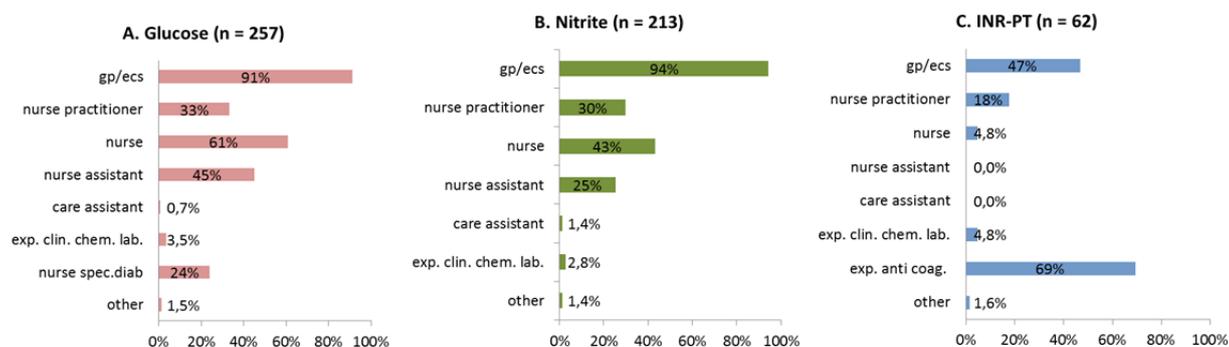


Figure 3. Interpretation of test results per type of health care professional, glucose (panel A), nitrite (panel B) and INR-PT tests (panel C). Respondents could choose more than one answer. gp – general practitioner, ecs – elderly care specialist

3.2.2

Final responsibility

A large proportion of the respondents (77%) that reported the use of POC tests had an employee who bore final responsibility for the use of POC tests. But 23% of them reported that they did not have an employee with the final responsibility. The employees who bear final responsibility are most often GPs/elderly care specialists, nurses and nurse assistants (see Table 3). In few of the nursing homes does the final responsibility lie solely with the nurse assistant (n=13) or with the nurse assistant and care assistant (n=1).

Table 3 Type of health care professional bearing final responsibility for the use of POC tests (n=201)

Type of health care professional*	N	%
GPs/elderly care specialist	116	58
Nurse practitioner	90	45
Nurse assistant	75	37
Management	50	25
Nurse	28	14
Other	19	9.4
Care assistant	2	0.9

*Respondents could choose more than one answer.

3.3 Training and the use of protocols

As part of the organisation's quality management system, it is strongly recommended that manuals or protocols for the specific POC tests are available, that users of POC tests within a health care organization are trained to use the POC test and that periodical refresher courses on using the POC tests are provided [2, 9, 10].

A large proportion, but not all of the respondents using POC tests indicated that they use manuals from the manufacturer or protocols written for their own nursing home/organization (see Table 4). For the D-dimer test, manuals/protocols were used in only 38% of the nursing homes. Ninety-four percent (203 out of 216) of the respondents using manuals/protocols indicated that the protocol obtained information on which type of health care professional was allowed to perform the test. For an overview of the results on use of manuals/protocols, see Table 4.

Table 4 Use of manuals/protocols by POC test users.

POC test users (n)	Use of manuals/protocols	
	n	%
Glucose (n= 257)	210	82
Nitrite (n= 213)	158	74
INR (n= 62)	46	74
Dipslide (n= 44)	30	68
Other (n= 16)	15	94
D-dimer (n= 21)	8	38

Three-quarters of the respondents (75%) indicated that training is provided to the users of POC tests (n = 195 out of 260 users). Most of them (91%) register those who have completed the training (177 out of 195). Training is given most often by nurses, followed by nurse practitioners and manufacturers/ suppliers (see Table 5).

Table 5 Providing training to POC test users

Providing training (n = 195)		n	%
Type of health care professional*	Nurse	121	62
	Other	56	9.4
	Manufacturer/ supplier	49	25
	Nurse practitioner	46	24
	Expert anti-coagulation service	31	16
	GPs/elderly care specialist	16	8.2
	Expert clinical chemical lab	12	6.1
	Nurse assistant	11	5.6
	Care assistant	0	0

* Respondents could choose more than one answer.

Training is most often provided to users of glucose tests and INR-PT tests (See Figure 2). For nitrite tests, only 38% of the respondents indicated that training is provided. Respondents indicated that refresher courses are given to approximately half of the users of glucose tests and INR-PT. For other tests, the percentage of users receiving refresher courses is even lower (Figure 4). A substantial number of users indicated that no training and no refresher training courses at all are provided, as shown in Figure 4.

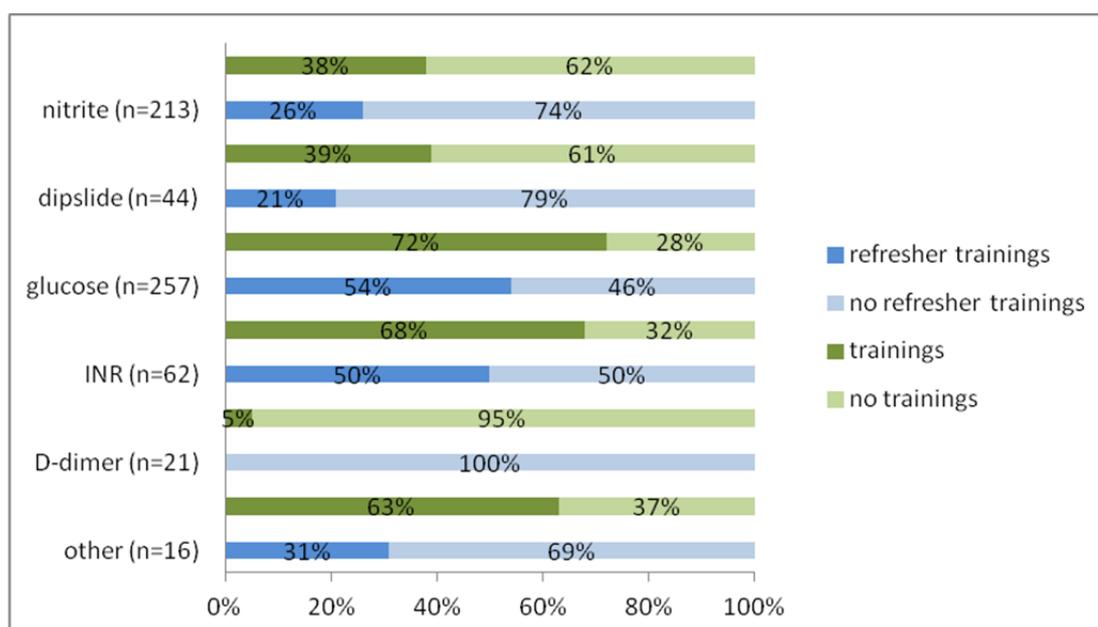


Figure 4 Percentage of respondents providing training, refresher training courses, or no training for each test. Presented as a percentage of respondents that indicated they used the respective tests.

3.4 Pre-analytical phase

3.4.1 General control measures taken upon receiving the test materials

Fifty-seven percent (149 out of 260) of the respondents indicated that they perform control measures upon receiving the tests, such as checking the expiration date (97%), the completeness of the test kit (70%), damage to packaging (70%) and storage conditions (54%). A minority checked the presence of a CE-mark (19%) or performed other control measures (11%).

3.4.2 Maintenance of blood POC test equipment (blood glucose and INR-PT tests)

Performing maintenance (including calibration, validation and cleaning procedures) on a regular basis is important for the continued accuracy of blood glucose meters and INR-PT meters [9, 10]. Respondents were therefore asked whether or not they perform maintenance (including calibration, validation and cleaning) and, if so, who carries out these activities.

It was indicated by 81% (209 out of 257) of the respondents that use blood glucose meters that maintenance is regularly performed on the meters. For the INR-PT test, this percentage is 89% (55 out of 62).

For glucose tests, the maintenance is most often performed by a maintenance company, the manufacturer and the nurses (Table 6).

The maintenance of INR-PT tests is most often performed by the anti-coagulation service and, to a lesser extent, by manufacturers, maintenance companies and others (Table 6).

Table 6 Performance of maintenance by type of professional.

Type of professional*	Glucose test (n= 209)		INR-PT test (n =55)	
	n	%	n	%
Maintenance company	73	35	8	15
Manufacturer/ supplier	68	33	11	20
Nurse	55	26	2	3.6
Nurse assistant	48	16	3	5.5
Other	47	23	8	15
Expert clinical chemical lab	19	9.1	5	9.1
Nurse practitioner	14	6.7	4	7.3
Care assistant	2	0.7	0	0.0
GPs/elderly care specialist	1	0.5	0	0.0
Expert anti-coagulation service	NA	NA	36	66

* Respondents could choose more than one answer. NA –Not applicable

3.4.3 Control measures before carrying out the test

Important pre-analytical control measures taken for blood glucose tests, nitrite tests and INR-PT tests are: checking the expiration date and checking whether the test strips are clean and undamaged [10].

Most respondents reported that they carry out these control measures (Figure 5).

Specific control measures taken for blood glucose tests are: checking the correspondence of the code of the test strip with the meter [10], and taking account of the moment of testing.

Failing to check whether or not the code of the test strip corresponds with the meter could lead to incorrect measurements of the blood glucose level. This has happened in several cases [11]. Taking the moment of testing into account is important in relation to moments of food intake and medication intake.

Most respondents (>80%) using blood glucose meters reported that they carry out these control measures.

For nitrite tests, an important specific control measure is to limit the time period between the sampling and testing of a urine sample. In order to avoid false positive results, urine samples must be tested within 2 hours of taking the sample when stored at room temperature and within 24 hours when stored in a

refrigerator [3]. Seventy-seven per cent of the respondents reported that they take into account the moment the urine sample is tested.

A specific important control measure for INR-PT tests is taking into account the use of medication by the patient. The use of specific medicines can influence the INR-PT test outcome [12]. Apart from this pre-analytical control measure, it is important to validate the use of the INR-PT POC test for each individual patient against the standard measurement method used in a laboratory twice a year [13, 14]. Seventy-six per cent of the respondents using INR-PT tests indicated that they check the use of medication, while the individual validation is performed by 68% of the respondents (Figure 5).

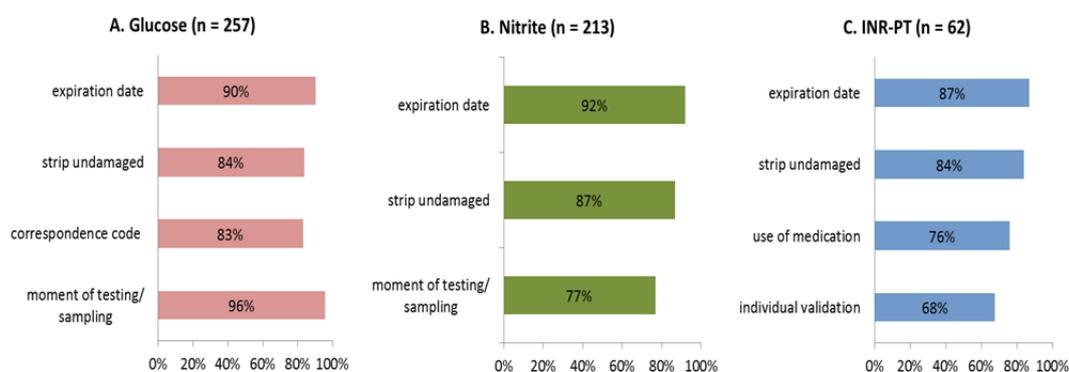


Figure 5. Pre-analytical phase: control measures for glucose (panel A), nitrite (panel B) and INR (panel C) tests. Respondents could choose more than one answer.

In the Netherlands, the anti-coagulation services play an important role in INR-PT testing. It is possible for nursing homes to collaborate with an anticoagulation service to ensure the presence of expertise in anticoagulation testing. Of the respondents using INR-PT POC tests, the majority indicated that they collaborate with an anti-coagulation service (81%). All of these were affiliated with the Federation of Dutch Anticoagulation Service (Federatie Nederlandse Trombosediensten).

3.5 Analytical phase

3.5.1 Patient identification

The majority (>90%) of the respondents reported that they verify the identity of the patient when performing a test (glucose tests 92%, nitrite tests 91%, and INR-PT tests 92%).

3.5.2 Hygienic procedures when using blood tests

Universal hygienic precautions taken to protect the patient and the professional against infectious materials when a blood sample is collected involve the professional washing his or her hands before and after testing a patient and putting on gloves before collecting blood samples [10, 15]. In addition, washing or disinfecting the patient's finger before collecting blood is also an important procedure to follow in order to prevent sample contamination (e.g. from food residues on the hands) which would possibly interfere with the test results [5, 16].

The respondents that use glucose tests (n =257) have implemented various types of hygienic measures (see Figure 6). Among the respondents, 3.9% (n=3)

reported that they did not use any hygienic control measure before performing a test (washing hands, wearing gloves or using disinfectants). Eighteen percent of the respondents (n=47) do not take any hygienic measure for the patient (washing or disinfecting finger). Among the respondents that reported they use INR-PT tests, 61% indicated that they are attentive to the wearing of gloves by the professional (Figure 6).

3.5.3 *Sample handling when using blood tests*

When collecting a blood sample, it is recommended that specific precautions are taken to optimize test results. For glucose tests, it is advised that the first drop of blood should be removed, since it tends to contain some tissue fluid and possible contamination of substances from the skin ([10, 17]. For INR-PT tests, it is advised that one first check whether or not the finger is dry and then, in contrast with blood sampling for glucose tests, use the first drop of blood; the sample must be applied to the test strip within 15 seconds [18, 19]. For both tests, squeezing the blood out of the finger should be avoided to prevent tissue fluid diluting the blood. In addition, for both tests the entire test area on the strip should be filled with blood.

For glucose tests and INR-PT tests, most of the respondents avoid applying pressure to the finger and check whether or not the entire test area on the strip has been filled (Figure 6). The majority of the respondents using blood glucose tests indicated that the first drop of blood is removed. For INR-PT tests, most of the respondents indicated that they check whether or not the finger is dry, that the first drop of blood is used, and that the blood sample is applied to the test strip within 15 seconds (Figure 6).

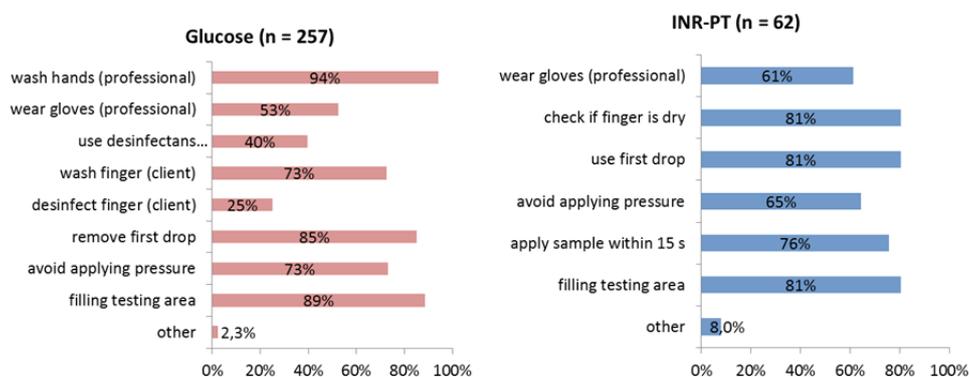


Figure 6 Analytical phase: control measures for glucose (panel A) tests and INR-PT (panel B) tests. Respondents could choose more than one answer.

3.6 Post-analytical phase

3.6.1 *Recording test results*

Almost all respondents indicated that they record the test results. This was done by more than 99% of the respondents that use blood glucose tests and also by more than 99% of the nitrite tests users. All respondents that use INR-PT tests indicated that they record the test result (100%).

3.6.2 *Conflict between test results and symptoms*

Respondents that indicated that they use nitrite tests and/or glucose tests were asked how often conflicts occurred between test results and symptoms. Respondents were asked to give an estimate by choosing one of four categories:

often (more than once a month), sometimes (several times per year), rarely (once a year) or never.

The occurrence of a conflict between test results and symptoms varied (Table 7). A few respondents noted conflicts more than once a month. Most respondents of both tests indicated that they noted conflicts sometimes (several times a year) or rarely (once a year) saw a conflict between test results and symptoms. A small minority of the respondents of both tests never observed a conflict between the test results and symptoms (Table 7).

Table 7 Occurrence of conflicts between test results and symptoms — an estimation.

Occurrence rate	Nitrite test (n= 213)		Glucose test (n =257)	
	n	%	N	%
Often (more than once a month)	25	12	4	1.6
Sometimes (several times per year)	93	44	85	33
Rarely (once a year)	81	38	135	60
Never	14	6.6	5	5.8

3.6.3 *Control measures and actions taken when test results conflict with symptoms or results are out of range*

When a conflict occurs between test results and symptoms, actions are taken by a large majority of the respondents: 97 % of glucose test users and 95 % of nitrite test users.

The INR-PT test is used to monitor treatment with anticoagulant medication. When the INR-PT value is outside its desired range, actions are also taken by almost all respondents that use INR-PT tests (98 %).

Of the possible actions listed in the questionnaire, many of the respondents of all three tests reported that they repeated the test (Figure 7). A majority (>75%) of the respondents that use glucose tests indicated that they checked the meter. Less than half of the respondents that use INR-PT tests reported that they check the meter. More than half of the respondents that use blood glucose meters and nitrite tests reported that the expiry date of test materials was checked. For INR-PT tests users, the proportion was less than half (Figure 7). Other actions that were reported by many respondents were that they asked advice from a GP/elderly care specialist (glucose test and INR-PT test users), contacted an anticoagulation service, checked aspects that influence coagulation (INR-PT test users), and used a different meter (glucose test users). Actions that were reported by a minority of the respondents involved contacting the manufacturer (for all three tests), adjusting medication (glucose test users), taking a blood sample via venipuncture and sending it to a clinical chemical lab (glucose test users and INR-PT test users). For a complete overview, see Figure 7.

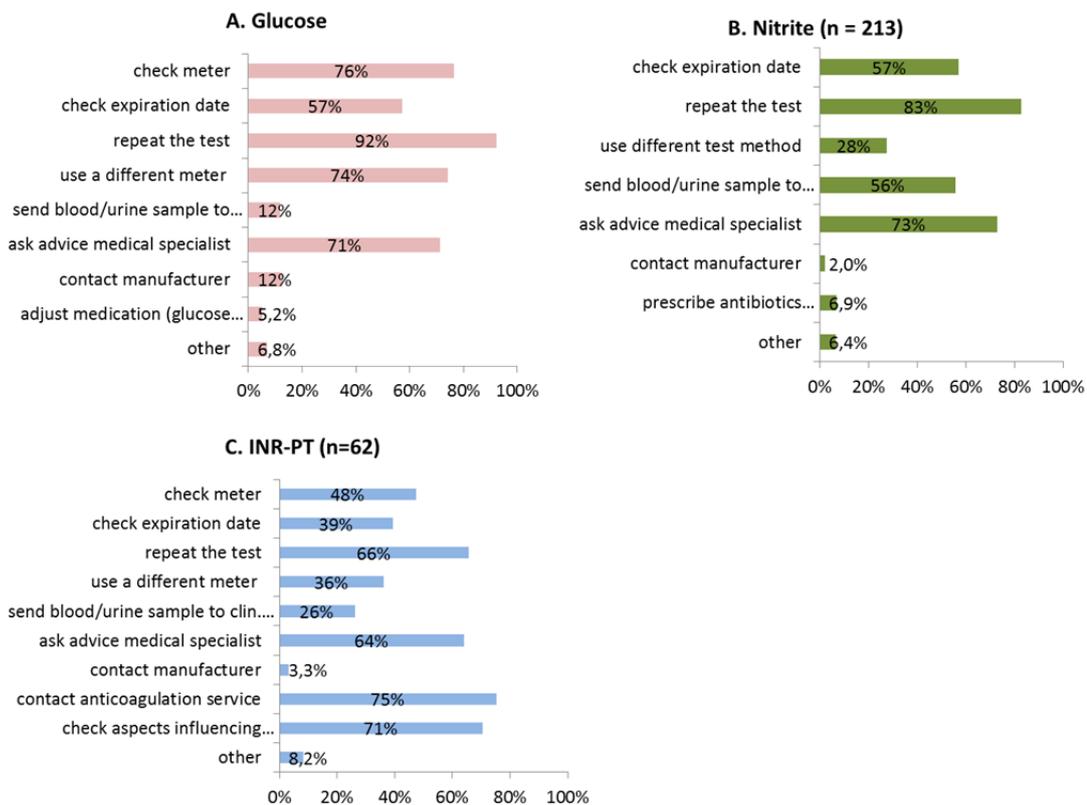


Figure 7 Actions taken when conflicts occur between test results and symptoms for glucose (panel A) and nitrite (panel B) tests. Actions taken when test results are outside the desired range for INR-PT tests (panel C). Presented as percentage of respondents that indicated they use the respective tests and indicated they take actions when conflicts occur. Respondents could choose more than one answer.

4 Discussion and conclusions

4.1 General

The aim of this explorative study was to investigate how patient safety aspects related to the use of POC tests are managed by health care professionals in nursing homes in the Netherlands. To our knowledge, this was the first study to investigate the use of POC tests in Dutch nursing homes. The majority (87%) of respondents reported the use of at least one type of POC test. In general, it can be concluded that most of the respondents control important elements of patient safety such as hygiene aspects, patient identification and maintenance and require actions to be taken when unexpected results occur. The provision of training and refresher courses and the use of protocols could be improved. The final responsibility for the use of POC tests was not clearly assigned in all nursing homes. Some of the crucial, specific control measures for the use of particular tests, such as checking that the code of a blood glucose test strip corresponds with the meter, were implemented in 70-80% of the nursing homes. But because these control measures are important for managing POC-related patient safety [1-4], all organisations should perform these control measures.

General conclusion:

POC tests are used frequently in a large majority of nursing homes, where the use of glucose tests and nitrite tests is most widespread. Most key elements of patient safety were reported to be managed well by the majority of nursing homes. Shortcomings were mainly observed with respect to training, protocols, and designating someone to bear responsibility for the use of POC tests.

Results will be discussed below for each key element.

4.2 Respondents characteristics and the use of POC tests

The survey was performed among 866 health care professionals in nursing homes, 35% (n=300) of which participated in the study. Some of the invitations remained unanswered because the questionnaire had already been completed through another e-mail address belonging to the same organization or because no inpatient elderly care was provided.

POC tests were used by a majority of the respondents (87%); of these, blood glucose tests and nitrite tests were used most frequently (>82%). These results are comparable to the results of the explorative study by de Vries (2012) [5] among 111 general practitioner practices. The blood glucose test was the most frequently mentioned test in hospitals, while urine nitrite tests were less frequently performed [6]. This indicates that blood glucose tests are used within a variety of health care settings and nitrite tests are predominantly used within primary and long-term care.

More than half of the respondents (58%) indicated that the final responsibility for the use of POC tests in nursing homes lies with the GP/elderly care specialist. This would be in line with the standards of the organisation for elderly care physicians [20, 21]. However, a large group of the respondents (45%) indicated that the nurse practitioner bore final responsibility for the use of POC tests. Moreover, in a few of the nursing homes this final responsibility lies only

with the nurse, nurse assistant or by the nurse assistant and care assistant. Furthermore, 33 % of the respondents indicated that the nursing home did not have an employee that bore final responsibility for the use of POC tests. The board of directors (management) should bear final responsibility for the quality of care provided within an organisation [22]. However, the GP/elderly care specialist is responsible for the health care he/she provides. This also includes responsibility for the use of POC tests. Although tasks can be delegated to other health care professionals, such as nurses or nurse assistants, the final responsibility for the adequate use of POC tests rests with the GP/elderly care specialist and the board of directors of the organisation.

The answers are not completely in line with aforementioned standards. Possibly the term 'final responsibility' has been interpreted in different ways. Multiple answers were allowed to describe the situation for different tests, but seem to have been interpreted as being allowed for one and the same test. Additionally, there might have been confusion about the terms 'professional' and 'final' responsibility, although the question was only about final responsibility. As a consequence, it is difficult to interpret the findings. Yet the fact that 23% of the respondents reported that no employee bears final responsibility does raise concerns.

Main conclusion on use of POC tests:

POC tests are used frequently in a large majority of nursing homes. The use of glucose tests and nitrite tests is most widespread. In the majority of nursing homes, the GPs/elderly care specialists or nurse practitioners are indicated as bearing final responsibility. However, approximately a quarter of the nursing homes reported that they have no employee that bears final responsibility for the use of POC tests.

4.3 Training and protocols

It is recommended that users of POC tests within a health care organisation are trained in using the POC test, have manuals or protocols for the specific POC tests available and take periodical refresher courses for using the POC tests [2, 9, 13].

Nitrite, blood glucose and INR-PT tests are used in nursing homes on a regular basis. Guidelines have been developed for diabetes care [23] and urinary tract infection care [24]. However, these guidelines do not include a specific description of how to use POC tests. The use of manuals or protocols was common for most respondents that use POC tests, except for the D-dimer test. However, considering the low number of respondents that use the latter tests, it is difficult to interpret these findings. Despite the fact that the use of manuals or protocols is common, there was a subset of nursing homes that reported that they did not use a manual or protocol. For example, 18% of glucose test users and 26% of INR-PT test users indicated that they did not use a manual or protocol. For GP practices, it was found that only a very low number of respondents read manuals before the actual use of a test. One explanation could be that they use these tests frequently, as was suggested in the study on GPs [5]. This could also be the case in our study in nursing homes. For glucose and INR-PT tests, two thirds (>65%) of the respondents indicated that training courses are provided. For other types of tests, these numbers were lower — for example, only 38 % of the respondents reported that initial training

for the use of nitrite tests was provided. Considering the widespread use of nitrite POC tests, this is a substantial number of nursing homes and thus represents a substantial risk for patient safety. Refresher courses were less frequently offered and uncommon for most respondents. Regular refresher courses are important since errors in using the tests may be introduced gradually and go unnoticed when the procedure is not regularly evaluated [10, 25].

The fact that not all nursing homes use protocols or manuals for the POC tests, together with the lack of refresher courses, indicates that some of the respondents do not have an adequate, systematic approach to prevent errors in use.

Main conclusion on training and protocols:

The use of manuals or protocols for various POC tests is common in most nursing homes, but was absent in approximately a quarter of the nursing homes.

The organisation of training and refresher courses is not adequately addressed in a substantial number of nursing homes.

4.4 Pre-analytical phase

Performing maintenance (including calibration, validation and cleaning procedures) on a regular basis is important for guaranteeing the accuracy of blood glucose meters and INR-PT meters [9, 10]. A large majority of glucose and INR-PT test users reported that their testing equipment was regularly maintained and that this was performed by experts, such as a maintenance company or a manufacturer.

General control measures upon receiving the test materials were not adequately carried out in most of the nursing homes. For example, the expiration date was checked by half of the respondents and the storage conditions were checked by approximately one-quarter of the respondents. Environmental influences, such as direct sunlight and humidity, do have an effect on the stability of the chemicals used on test strips [26]. Therefore, checking storage conditions and checking packaging for damage are important control measures. In the survey conducted among GPs [5], it was also found that storage conditions and checking the packaging for possible damage on receiving POC tests were not well-controlled aspects. One explanation for this could be that regular users of the tests are well aware of the storage conditions under the materials are kept and consciously do not check every time.

In the pre-analytical phase, just before the POC test is actually used, important control measures, such as checking the expiration date and checking whether the test strips are clean and undamaged [10], are carried out by a majority of the respondents.

Although the expiration date is checked by the majority of the respondents before using the POC, this is done less often upon receiving the POC test materials. This might lead to an acute shortage in usable POC test materials at the moment of testing, which could subsequently have a negative impact on the care given to the patient.

Specific control measures for blood glucose tests include checking that the code of the test strip corresponds with the meter [10], and taking the moment of

testing into account in relation to meals, exercise, etc. Most respondents (>80%) that use blood glucose meters reported that they implement these important control measures.

Main conclusion of pre-analytical phase:

In most nursing homes, maintenance and important pre-analytical control measures are adequately addressed.

General checks upon receiving the test materials and before using the test could be improved in several nursing homes.

4.5 Analytical phase

The misidentification of patients is a major patient safety issue in health care [25]. This aspect was well-managed by a majority of respondents (>90%).

For the blood tests investigated (glucose and INR-PT), many aspects need to be taken into account during the analytical phase. For both tests, key aspects were investigated.

Most of the investigated aspects were managed well by approximately two-thirds of the respondents. These aspects included the hand hygiene of the health care professional and the patient, removing the first drop of blood (glucose) or using the first drop of blood (INR-PT), and checking whether or not the entire test area was filled. On the other hand, a previous study among GPs indicated that hygiene aspects were often not adequately addressed [5]. In hospitals, substantial improvements were implemented on these aspects following an alert by the Dutch Health Care Inspectorate in 2008 on POC blood glucose measurements [2]. Results from these three studies suggest that quality and safety aspects related to the analytical phase are managed differently in various care settings.

Main conclusion of analytical phase:

Patient identification, hygienic measures (such as washing hands) and the handling of samples are managed well within the nursing homes participating in this study.

4.6 Post-analytical phase

Test results have to be recorded to ensure good management of patient disease and accessibility to these results over time and by the different health care professionals. Test results were recorded by almost all of the respondents.

Respondents that reported the use of nitrite tests and/or glucose tests were asked how often conflicts between test results and symptoms occurred. Conflicts were observed several times a year by more than a quarter of the respondents that use nitrite or glucose tests. Although not very often, some respondents indicated that they experience a conflict between a test result and symptoms even more often than once a month. Most of the respondents reported that they take the necessary control measures and actions when test results conflict with symptoms or results are out of range. Control measures and actions such as repeating the test, asking the advice of a GP/elderly care specialist and checking the meter are the measures taken by the majority of the users. Changing medication based on erroneous test results can result in serious problems [2] or, in the case of nitrite tests, can result in prescribing antibiotics unnecessarily. A

few respondents indicated that they contact the manufacturer. Only a few respondents (5.2 % glucose tests and 6.9 % nitrite tests) indicated that they changed medication or prescribed antibiotics when they observed conflicts between the test results and patient symptoms. Most of these respondents also took actions such as repeating the test or asking the advice of a GP/elderly care specialist. This indicates that the decision to change the medication or to prescribe antibiotics is an informed decision.

Main conclusion of post-analytical phase:

Conflicts between test results and symptoms or results being out of range do not occur frequently.

In general, adequate actions are taken when such events occur. Only a few respondents contact the manufacturer.

4.7 Limitations of the study

Caution must be taken when extrapolating the results of the study to the total population of Dutch nursing homes. To obtain the contact information of nursing homes, the 'KiesBeter' database was used. Only unique e-mail addresses identified from this database were used. But it was not clear beforehand whether each of these unique e-mail addresses belonged to a specific nursing home or to a group of nursing homes belonging to one organisation. Eventually, 57% of the respondents in this study were independent nursing homes and 43% were part of a larger organisation of multiple homes. No data are available to enable us to compare these percentages with those in the total population of nursing homes in the Netherlands.

Another aspect is that we have no information on the numbers of nursing homes in the different groups and organisations. For this reason, the percentage of nursing homes represented in this study cannot be directly related to the response rate of 36%.

At the moment, the 'KiesBeter' database is the best available source of contact addresses for nursing homes in the Netherlands.

Aspects that potentially introduce a bias into the results are socially desirable responses, differences in interpretation of the questions, and limitations in the knowledge of the person completing the survey. For the last of the three, it was noted that the survey was often completed by managers (45%) or GPs/elderly care specialists (20%), while POC tests are mainly carried out by nurses and nurse assistants (>80%). For a subset of questions, therefore, answers may have been provided that do not correctly reflect what actually happens during performance of the tests.

Nevertheless, this study provides an adequate indication of the use of POC tests and the management of patient safety aspects in Dutch nursing homes.

5 Recommendations

To maintain a good quality of care and to prevent incidents with POC tests, the following recommendations for the use of POC tests in nursing homes are made:

- The organisation of training and regular refresher courses should be improved, especially, though not only, when a test or an instruction on the use is changed.
- Every nursing home should have protocols with instructions on the use of POC tests as part of a quality management system,
- Control measures should be implemented upon receiving test materials and in the pre-analytical phase, i.e. checking the storage conditions, checking the packaging, calibration and maintenance.

Based on the results of this explorative investigation, further research is recommended. First of all, the dataset obtained during this investigation could be analysed further in order to answer additional research questions. By structuring the data in a different way, a more in-depth statistical analysis of the data would become possible, allowing for measures such as an investigation of any connection between the types of organisations or users and the scores on certain patient safety aspects. In addition, it may be possible to compare the dataset with datasets from previous investigations in different types of health care organisations.

Furthermore, a useful follow-up would be to investigate the impact of shortcomings in observational studies with regard to patient safety. This would allow a powerful corroboration of the results of the explorative study and a direct evaluation of the kind of harm that can result from inadequately implemented control measures.

Finally, another valuable research line would be to investigate to what extent the use of POC tests in nursing homes (or other modalities of care) reduces the use of expensive clinical laboratory testing, the prescription of medication or the referrals of patients.

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Appendix 1 Questionnaire (in Dutch)

Inleiding

Het Rijksinstituut voor Volksgezondheid en Milieu (RIVM) is bezig met een onderzoek naar het veilig gebruik van point-of-care (POC) testen in verpleeg- en verzorgingshuizen. Dit in opdracht van de Inspectie voor de Gezondheidszorg (IGZ).

POC testen zijn in vitro diagnostica die door zorgprofessionals in de nabijheid van cliënten worden gebruikt om snel een diagnose te stellen. POC testen kunnen apparaten of teststrips zijn, bijvoorbeeld bloedglucosemeters voor diabetes of nitriet teststrips voor urineweginfecties. Dit onderzoek betreft POC testen die door de zorgprofessional gebruikt worden en eigendom zijn van uw organisatie of eigendom van een klinisch laboratorium/trombosedienst waar u mee samenwerkt. Het onderzoek betreft dus **niet** zelftesten die eigendom zijn van cliënten.

Het van belang dat de persoon die verantwoordelijk is voor het gebruik van POC testen de vragenlijst invult.

Indien uw instelling uit meerdere locaties bestaat verzoeken wij u de antwoorden te selecteren die op de meeste locaties van toepassing zijn.

Vragenlijst:

1. Vult u deze enquête in voor 1 locatie of meerdere?

- Voor 1 locatie
- Voor meerdere locaties, maar deze verschillen niet in het gebruik van POC testen
- Voor meerdere locaties en er zijn verschillen in het gebruik van POC testen. Wij verzoeken u de antwoorden te kiezen die voor de meeste locaties van toepassing zijn.

2. Wat is de samenstelling van uw instelling met betrekking tot zorgzwaartepaketten (ZZP)?

- Voornamelijk ZZP 1 t/m 4
- Voornamelijk ZZP 5 t/m 10
- Beide categorieën ongeveer gelijk verdeeld

3. Wat is uw functie binnen de instelling?

- Huisarts/specialist ouderengeneeskunde
- Management functionaris
- Nurse practitioner/ verpleegkundig specialist (master/HBO opleiding).
- Verpleegkundige
- Verzorgende⁴
- Anders

4. Worden er POC testen in uw instelling gebruikt?

- Ja, ga naar vraag 4b
- Nee, hartelijk dank voor uw deelname, de volgende vragen zijn voor u niet van toepassing, u kunt de enquête afsluiten

⁴ Nurse assistant.

4b. Welke POC testen worden in uw instelling gebruikt? (meerdere opties mogelijk)

- Nitriet (urine­weginfecties)
- Dipslide (urine­weginfecties)
- Bloed glucose (diabetes)
- INR-PT (controle orale antistolling)
- D-dimeer (trombose/embolie)
- Overige

5. Zijn er medewerkers eindverantwoordelijk voor het gebruik van POC testen in uw instelling?

- Ja
- Nee

5b. Wie zijn er eindverantwoordelijk voor het gebruik POC testen in uw instelling? (meerdere opties mogelijk)

- Management functionaris
- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/ verpleegkundig specialist (master/HBO opleiding).
- Verpleegkundige
- Verzorgende
- Helpende⁵
- Anders

6. Heeft u voor het gebruik van POC testen samenwerkingen met specialistische organisaties?

- Ja
- Nee

6b. Met welke specialistische organisaties werkt u samen? (meerdere opties mogelijk)

- Met een klinisch chemisch laboratorium
- Met een trombosedienst
- Met een andere specialistische organisatie

7. Gebruikt u voor de POC testen gebruiksaanwijzingen van de test of protocollen die specifiek voor uw instelling geschreven zijn?

- Ja
- Nee

7b. Voor welke POC testen heeft u de gebruiksaanwijzing of u eigen protocollen? (meerdere opties mogelijk)

- Nitriet (urine­weginfecties)
- Dipslide (urine­weginfecties)
- Bloed glucose (diabetes)
- INR-PT (controle orale antistolling)
- D-dimeer (trombose/embolie)
- Overige

⁵ Care assistant.

8. Is in het protocol opgenomen welke functiegroepen (bijv. verpleegkundigen) POC testen mogen uitvoeren?

- Ja
- Nee

9. Worden er trainingen gegeven voor het gebruik van de POC testen?

- Ja
- Nee

9b. Voor welke test worden er trainingen gegeven? (meerdere opties mogelijk)

- Nitriet
- Dipslide
- Glucose
- D-Dimeer
- INR-PT
- Overige

10. Wie geeft de training over het gebruik van POC testen? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende Expert vanuit het klinisch chemisch laboratorium
- Expert vanuit trombosedienst
- Fabrikant/leverancier van de test
- Andere

11. Wordt er geregistreerd door de instelling wie deze training heeft doorlopen?

- Ja
- Nee

12. Worden er regelmatig (minimaal 1x per 2 jaar) herhalingstrainingen gegeven over het gebruik van POC testen?

- Ja
- Nee

12b. Voor welke POC testen worden deze herhalingstrainingen gegeven? (meerdere opties mogelijk)

- Nitriet
- Dipslide
- Glucose
- D-Dimeer
- INR-PT
- Overige

13. Worden er controles uitgevoerd bij aflevering van de POC testen?

- Ja
- Nee

13b. Welke controles worden er uitgevoerd bij aflevering van POC testen?

(meerdere opties mogelijk)

- Controleren houdbaarheidsdatum van de test strips
- Controleren opslag condities (bijvoorbeeld temperatuur)
- Controleren of testen compleet zijn
- Controleren of verpakkingen onbeschadigd zijn
- Aanwezigheid CE markering
- Anders

Vragen gerelateerd aan het gebruik van bloedglucose POC testen

14. Hoe vaak worden bloed glucose testen in uw instelling gebruikt?

- Dagelijks
- Wekelijks
- Maandelijks
- Jaarlijks

15. Wie voeren de bloedglucose POC testen uit? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Anders

16. Aan welke aspecten wordt aandacht besteed voor het nemen van een bloedmonster en uitvoeren van de test? (meerdere opties mogelijk)

- Tijdstip van de dag (t.o.v. eetpatroon cliënt of inname van medicijnen)
- Controleren of code van de teststrip overeenkomt met de code op het apparaat
- Houdbaarheidsdatum van de teststrip controleren
- Controleren of de teststrips schoon en onbeschadigd zijn
- Identiteit van de cliënt
- Handen wassen en/of desinfecteren (zorgverlener)
- Dragen van handschoenen (zorgverlener)
- Vinger van de cliënt wassen en/of desinfecteren
- Eerste druppel bloed verwijderen
- Voorkomen dat bloed in de vinger gestuwd wordt
- Controleren dat het hele test gebied van de strip gevuld is
- Anders

17. Worden de testresultaten geregistreerd?

- Ja
- Nee.

18. Wie interpreteert de resultaten van de bloedglucose POC testen? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/ HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende

- Expert van het klinisch laboratorium
- Diabetesverpleegkundige
- Anders

19. Hoe vaak komt het voor dat de testresultaten en symptomen niet met elkaar in overeenstemming zijn?

(NB: Het betreft hier een inschatting!)

- Nooit
- Zelden (incidenteel, ongeveer 1x per jaar)
- Soms (meerdere keer per jaar)
- Vaak (meer dan 1x per maand)

20. Worden er acties ondernomen wanneer de testresultaten en symptomen niet met elkaar in overeenstemming zijn?

- Ja
- Nee.

20b. Welke acties worden er ondernomen wanneer de testresultaten en symptomen niet met elkaar in overeenstemming zijn? (meerdere opties mogelijk)

- Controleren van de meter
- Houdbaarheidsdatum van de strip of reagentia controleren
- Herhalen van de test
- Een andere meter gebruiken
- Bloed monster nemen via venapunctie en opsturen naar laboratorium
- Advies vragen aan een specialist (bijvoorbeeld huisarts, specialist ouderenzorg, klinisch chemicus van het laboratorium)
- Contact opnemen met de fabrikant
- Toch medicatie aanpassen
- Anders

21. Wordt er structureel onderhoud gepleegd aan bloedglucose POC testen (valideren, kalibreren en schoonmaken van meters):

- Ja
- Nee

21b. Door wie wordt dit onderhoud gepleegd? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/ verpleegkundig specialist (master/HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Expert klinisch laboratorium
- Fabrikant/Onderhoudsfirma
- Anders

Vragen gerelateerd aan het gebruik van nitriet POC testen

22. Hoe vaak worden nitriet POC testen in uw instelling gebruikt?

- Dagelijks
- Wekelijks
- Maandelijks
- Jaarlijks

23. Wie voeren de nitriet POC testen uit? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Anders

24. Aan welke aspecten wordt aandacht besteed voor het type urinemonster en het uitvoeren van de test? (meerdere opties mogelijk)

- Houdbaarheidsdatum van de teststrip controleren
- Controleren of de teststrips schoon en onbeschadigd zijn
- Afnamemoment van urinemonster, ga naar vraag 24b
- Identiteit van de cliënt
- Anders

24b. Welke type urinemonsters worden gebruikt?

- Alleen ochtend urinemonsters worden gebruikt
- Alleen een ochtend urinemonster dat maximaal twee uur voor de test is verzameld wordt gebruikt
- Alle typen urine monsters worden gebruikt

25. Worden de testresultaten geregistreerd?

- Ja
- Nee.

26. Wie interpreteert de resultaten van de nitriet POC testen? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/ HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Expert van het klinisch laboratorium
- Anders

27. Hoe vaak komt het voor dat de testresultaten en symptomen niet met elkaar in overeenstemming zijn?

(NB: Het betreft hier een inschatting!)

- Nooit
- Zelden (incidenteel, ongeveer 1x per jaar)
- Soms (meerdere keer per jaar)
- Vaak (meer dan 1x per maand)

28. Worden er acties ondernomen wanneer de testresultaten en symptomen niet met elkaar in overeenstemming zijn?

- Ja
- Nee.

28b. Welke acties worden er ondernomen wanneer de testresultaten en symptomen niet met elkaar in overeenstemming zijn? (meerdere opties mogelijk)

- Herhalen van de test
- Houdbaarheidsdatum van de strip controleren
- Urine monster opnieuw testen met een andere test (bijvoorbeeld dipslide)
- Urine monster opsturen naar laboratorium
- Advies vragen aan een specialist (bijvoorbeeld huisarts, specialist ouderenzorg, klinisch chemicus van het laboratorium)
- Preventief antibiotica voorschrijven
- Contact opnemen met de fabrikant
- Anders

Vragen gerelateerd aan INR-PT testen (controle orale antistolling)

29. Hoe vaak worden INR-PT POC testen in uw instelling gebruikt?

- Dagelijks
- Wekelijks
- Maandelijks
- Jaarlijks

30. Werkt u voor de controle van orale antistolling samen met een trombosedienst?

- Nee
- Ja, met een trombosedienst aangesloten bij de Federatie voor Nederlandse trombosediensten (FNS)
- Ja, met een trombosedienst niet aangesloten bij de FNS

31. Wordt van te voren bepaald of een cliënt gemonitord kan worden met de INR-PT POC test? (validatie t.o.v. reguliere meting veneus bloed)

- Ja
- Nee

32. Wie voeren de INR-PT POC metingen uit? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Medewerker trombosedienst
- Anders

33. Aan welke aspecten wordt aandacht besteed voor het nemen van een bloedmonster en uitvoeren van de test? (meerdere opties mogelijk)

- Houdbaarheidsdatum van de teststrip controleren
- Controleren of de teststrips schoon en onbeschadigd zijn
- Identiteit van de cliënt
- Medicatie gebruik van de cliënt
- Dragen van handschoenen (zorgverlener)
- Controleren of code test strip overeenkomt met code op het apparaat
- Controleren of de vinger droog is
- Eerste druppel bloed gebruiken
- Voorkomen dat bloed in de vinger gestuwd wordt.
- Bloedmonster binnen 15 seconden opbrengen
- Zorgen dat het hele test gebied van de strip gevuld is
- Overige

34. Worden de test resultaten geregistreerd?

- Ja
- Nee

35. Wie interpreteert de resultaten van de INR-PT POC testen? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/verpleegkundig specialist (master/ HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Expert van het klinisch laboratorium
- Expert van de trombosedienst
- Anders

36. Wordt er structureel onderhoud gepleegd aan de INR-PT meters (valideren, kalibreren en schoonmaken van meters):

- Ja
- Nee

36b. Door wie wordt dit onderhoud gepleegd? (meerdere opties mogelijk)

- Huisarts/specialist ouderengeneeskunde
- Nurse practitioner/ verpleegkundig specialist (master/HBO opleiding)
- Verpleegkundige
- Verzorgende
- Helpende
- Expert klinisch laboratorium
- Trombosedienst
- Fabrikant/Onderhoudsfirma
- Anders

37. Worden er acties ondernomen wanneer de INR-PT waarde ver buiten de streefwaarde ligt?

- Ja
- Nee.

37b. Welke acties worden er ondernomen wanneer de INR-PT ver buiten de streefwaarde ligt? (meerdere opties mogelijk)

- Controleren van de meter
- Houdbaarheidsdatum van de strip of reagentia controleren
- Herhalen van de test
- Een andere meter gebruiken
- Controleren van aspecten die de stolling kunnen beïnvloeden (bijvoorbeeld medicatie gebruik)
- Contact opnemen met de trombosedienst
- Bloed monster nemen via venapunctie en opsturen naar laboratorium
- Advies vragen aan een specialist (bijvoorbeeld huisarts, specialist ouderenzorg)
- Contact opnemen met de fabrikant
- Anders

Appendix 2. Letters sent to the Nursing homes (in Dutch)

Aankondiging

Geachte heer/mevrouw,

De Inspectie voor de Gezondheidszorg (IGZ) heeft opdracht gegeven aan het Rijksinstituut voor Volksgezondheid en Milieu (RIVM) om het gebruik van point-of-care (POC) diagnostische testen, bijvoorbeeld de bloedglucosetest, in Nederlandse verpleeg- en verzorgingshuizen te onderzoeken. Graag willen wij u verzoeken om uw medewerking aan dit onderzoek te verlenen door een digitale enquête in te vullen.

U ontvangt binnenkort een uitnodiging voor deze enquête per e-mail met als afzender poc-verpleeghuizen@rivm.nl en als onderwerp: *Enquête onderzoek point-of-care (POC) diagnostische testen in verpleeg-en verzorgingshuizen*. Uw instelling is gekozen uit een databestand van KiesBeter. De resultaten van dit onderzoek zullen geheel anoniem worden gerapporteerd. Het is mogelijk dat u onlangs ook door ons benaderd bent voor medewerking aan het onderzoek: **Onderhoud klasse 1 medische hulpmiddelen verpleeg- en verzorgingshuizen**. Het betreft hier twee onafhankelijke onderzoeken die beide uitgevoerd worden door het RIVM in opdracht van IGZ. Indien u beide uitnodigingen ontvangt, verzoeken wij u om aan beide onderzoeken uw medewerking te verlenen.

Voor eventuele vragen kunt u contact opnemen met het onderzoeksteam van het RIVM E-mailadres: poc-verpleeghuizen@rivm.nl

Bij voorbaat hartelijk dank,

Met vriendelijke groet,

Brief met link naar Enquête

Geachte heer/mevrouw,

Onlangs heeft u bericht ontvangen van de Inspectie voor de Gezondheidszorg (IGZ) betreffende het onderzoek naar het gebruik van point-of-care (POC) diagnostische testen in Nederlandse verpleeg- en verzorgingshuizen. IGZ heeft het Rijksinstituut voor Volksgezondheid en Milieu (RIVM) gevraagd om dit onderzoek uit te voeren.

Er is op dit moment weinig bekend over de wijze waarop POC diagnostische testen gebruikt worden binnen verpleeg- en verzorgingshuizen. POC testen zijn in-vitro diagnostica die in de nabijheid van cliënten kunnen worden gebruikt om snel een diagnose te stellen. POC testen kunnen apparaten of teststrips zijn. Voorbeelden zijn de bloedglucosetest (bloedsuiker) en de nitriettest (urinewegs infectie).

Graag willen wij u verzoeken om uw medewerking aan dit onderzoek te verlenen door een digitale enquête in te vullen. Deze enquête kunt u openen door op de volgende link te klikken: <[webmailadres](#)>

Het invullen van de enquête duurt 15-30 minuten. Het is van belang dat de persoon verantwoordelijk voor het gebruik van POC diagnostische testen in uw instelling de vragenlijst invult. Indien uw instelling uit meerdere locaties bestaat, willen wij u verzoeken de antwoorden te kiezen die op de meeste locaties van toepassing zijn.

U kunt de enquête slechts eenmaal invullen.

Het onderzoek betreft POC diagnostische testen die door de zorgprofessional gebruikt worden en eigendom zijn van uw instelling of van een samenwerkingspartner, dus niet de testen die eigendom zijn van de cliënten zelf. Indien uw instelling geen POC diagnostische testen gebruikt of in eigendom heeft, willen wij u verzoeken toch vraag 1 tot en met 4 van de enquête in te vullen.

Uw instelling is gekozen uit een databestand van KiesBeter. De resultaten van dit onderzoek zullen geheel anoniem worden gerapporteerd. Voor eventuele vragen kunt u contact opnemen met het onderzoekteam van het RIVM. E-mailadres: POC-Verpleeghuizen@rivm.nl

Wij verzoeken u om de enquête binnen 3 weken in te vullen.

Bij voorbaat hartelijk dank,

Met vriendelijke groet,

1^{ste} herinnering

Geachte heer/mevrouw,

Enige tijd geleden heeft u van ons een uitnodiging ontvangen voor het onderzoek naar point-of-care (POC) diagnostische testen in Nederlandse verpleeg- en verzorgingshuizen (zie onderstaand bericht). Indien u deze nog niet heeft ingevuld, willen wij u verzoeken dit alsnog te doen. Het is mogelijk dat u de enquête reeds heeft ingevuld, in dat geval hoeft u niets te doen. De enquête kunt u openen door de volgende link aan te klikken:

<webmailadres>

Wij verzoeken u om de enquête binnen twee weken in te vullen.

Voor eventuele vragen kunt u contact opnemen met het onderzoekteam van het RIVM.

E-mailadres: POC-Verpleeghuizen@rivm.nl

Bij voorbaat hartelijk dank,

Met vriendelijke groet,

2^{ste} herinnering

Geachte heer/mevrouw,

Enige tijd geleden heeft u van ons een uitnodiging ontvangen voor het onderzoek naar point-of-care (POC) diagnostische testen in Nederlandse verpleeg- en verzorgingshuizen (zie onderstaand bericht). Indien u deze nog niet heeft ingevuld, willen wij u verzoeken dit alsnog te doen. Het is mogelijk dat u de enquête reeds heeft ingevuld, in dat geval hoeft u niets te doen. De enquête kunt u openen door de volgende link aan te klikken:

<webmailadres>

Wij verzoeken u om de enquête binnen twee weken in te vullen.

Voor eventuele vragen kunt u contact opnemen met het onderzoekteam van het RIVM.

E-mailadres: POC-Verpleeghuizen@rivm.nl

Bij voorbaat hartelijk dank,

Met vriendelijke groet,

Appendix 3 ZZP categories and type of health care professionals in nursing homes

<i>ZZP categories</i>	<i>Description</i>
1	Living with little support
2	Living with support and care
3	Living with support and intensive care
4	Living with intensive support and intensive care
5	Living with intensive care (dementia)
6	Living with intensive care and nursing
7	Living with highly intensive care (with psychiatric disorder/dementia)
8	Living with highly intensive care and nursing
9a	Living with care and nursing aimed at recovery (short-term)
9b	Living with care and nursing aimed at recovery (long-term)
10	Living with intensive palliative care

<i>Type of healthcare professionals</i>	<i>Description</i>
Elderly care physicians	Specialist in elderly care (field of expertise: co-morbidity, multi-morbidity and polypharmacy).
Nurse practitioner	Advanced nursing practices: authorized to perform physician tasks: physical examination, give infusion, perform punctures, accompanying chronically ill patients, coordinate medical care (under supervision of the GPs/elderly care specialist)
Nurse	Nursing practices (under supervision of the GP/elderly care specialist)
Nurse assistant	Help patients to perform the most basic daily tasks. (supervision department head, e.g. elderly care physician)
Care assistant	Assist patients with their activities of daily living (supervision department head, e.g. elderly care physician)
Expert clinical chemical lab	Expert in performing various diagnostic tests (supervision head of the clinical chemical lab: Clinical chemist)
Expert thrombosis service	Expert in performing anticoagulation diagnostic tests (supervision head of the clinical chemical lab: Clinical chemist)

Source: Verenso, 2012 [21], NVKC, 2005 [29]

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