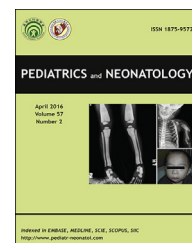


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ORIGINAL ARTICLE

Impact of a Developmental Care Training Course on the Knowledge and Satisfaction of Health Care Professionals in Neonatal Units: A Multicenter Study



Rocío Mosqueda-Peña ^{a,*}, David Lora-Pablos ^b,
Abraham Pavón-Muñoz ^c, Noelia Ureta-Velasco ^a,
María Teresa Moral-Pumarega ^a, Carmen Rosa Pallás-Alonso ^a

^a Neonatal Unit, 12 de Octubre Hospital, Madrid, Spain

^b Research Unit, 12 de Octubre Hospital, Madrid, Spain

^c Administration and Documentation, Neonatal Unit, 12 de Octubre Hospital, Madrid, Spain

Received Dec 11, 2014; received in revised form Mar 11, 2015; accepted Apr 1, 2015

Available online 4 June 2015

Key Words

continuing education;
developmental care;
evaluation;
neonatal units;
questionnaire

Background: The impact of health-related continuing education courses on knowledge acquisition and clinical practice is infrequently evaluated, despite higher numbers of people enrolling in them. The majority of health care professionals working in neonatal intensive care units (NICUs) have received no training in developmental care (DC). The purpose of this study was to determine whether participation in a theoretical-practical course on DC had an effect on the degree of knowledge possessed by professionals in general terms and with respect to neonatal intensive care. The relationship between course satisfaction and knowledge acquisition was also studied.

Methods: This was an observational multicenter study conducted in 20 neonatal units in Madrid. A pre- and post-course questionnaire evaluated both knowledge and satisfaction levels regarding the course on DC and the Newborn Individualized Developmental Care and Assessment Program (NIDCAP). We carried out a multivariate linear regression analysis to determine whether there was a correlation between knowledge gained and satisfaction level.

Results: A total of 566 professionals participated, with a 99% pre-course and a 90% post-course response rate. The mean rate of correct pre-course answers was 65%, while the mean rate of post-course correct answers was 81% ($p < 0.001$). Results were similar at all levels of neonatal care (Level I: 64% vs 80%; Level II: 64% vs. 83%; and Level III: 65% vs. 81%). Scores on a scale of satisfaction from 1 to 5 were high (averages of above 4 for all lectures and workshops). Pre-course knowledge scores, but not satisfaction, significantly influenced post-course knowledge (β 0.499; $p < 0.01$).

* Corresponding author. Neonatal Unit, 12 de Octubre Hospital, Avenida de Córdoba s/n 28041, Madrid, Spain.
E-mail address: romospe@hotmail.com (R. Mosqueda-Peña).

Conclusion: Previous DC knowledge among Madrid health care professionals was similar, regardless of the level of neonatal care. Course attendance significantly improved the rate of correct answers. Although course satisfaction was high, there did not seem to be a correlation between knowledge gained and satisfaction.

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1. Introduction

Given continuous advances and changes in the medical field, health care professionals increasingly enroll in continuing education courses to respond to the constant challenge to acquire and maintain skills.^{1–7} There is an ever-growing number of courses aimed at professional improvement, and the demand for a minimum number of annual accredited refresher courses is also on the rise. However, despite the increase in courses offered, their actual impact on learning and clinical practice often passes unevaluated. In general, the degree of overall course satisfaction is assessed upon course completion, while the ultimate goal of the course, namely the acquisition of knowledge and skills that lead to an improvement in competence and professional output, is not evaluated. It would be interesting to see whether there is a relationship between the degree of learner satisfaction and knowledge gained. If learner satisfaction could be used to measure the course's impact on learning indirectly, it might be considered an adequate indicator. However, if this relationship cannot be verified, the degree of knowledge acquired in the majority of courses would go unmeasured, and the success of the course would remain unverified. Moreover, often the only professional demand made on course participants is simply proof of attendance.⁸

In recent years, developmental care (DC) has been receiving a lot of attention in the field of neonatology, as is the standardized program of personalized care which is known as the Newborn Individualized Developmental Care and Assessment Program (NIDCAP), developed by Als.⁹ By DC, we refer to the care designed to promote neurosensory and emotional development in newborns while reducing stress during admission to the neonatal unit. DC includes modifying external stimuli (visual, auditory, tactile, and vestibular), clustering nursing care activities, positioning and containment, and reinforcing the bond between family and infant.^{10,11} Several publications suggest that these methods have a positive impact on infant care.^{12–19} However, the majority of health care professionals working on the neonatal intensive care unit (NICU) receive no training in DC in medical school, and very few receive any training during their period of specialization. In addition, as shown in the literature, there are vast differences in the application of DC.^{20,21}

An educational program on DC was implemented in all of the neonatal units in the region of Madrid (Spain). An assessment of both participant satisfaction and pre- and post-course knowledge was included in the design of this continuing education program. The aim of our study was to determine whether the degree of knowledge possessed by

the professionals attending the theoretical-practical courses on DC improved overall, both at the level of the individual participating hospital and at the level of the NICU, after taking part in the courses. We also studied the relationship between course satisfaction and knowledge acquisition.

2. Methods

This was a multicenter observational study with a before-and after-course design, conducted in 2011. Two neonatologists and two neonatal nurses from Hospital 12 de Octubre, Madrid, Spain were sent to teach a DC course in the 20 hospitals in Madrid with neonatal units. At least one of the doctors and one of the nurses delivering the course were trained in NIDCAP. The course was the same for each center. Course participants included neonatologists, nurses, and nursing assistants. The department heads of each unit were responsible for selecting participants and ensuring that all designated professional groups and shift patterns were represented in order for the sample to be representative of each unit. The recommendation in terms of attendance was 20 practitioners per course; however, in each of the three largest units (Level IIIC), two courses were given in order to reach the greatest number of practitioners. Overall, 23 courses were organized for 566 professionals. [Appendix 1](#), based on the article published by Rite Gracia et al,²² includes the characteristics of each participating hospital according to level of neonatal care. This paper, published in 2012, is a review based on the first document, produced in 2004, to define health care levels in Spanish hospitals in relation to neonatal care. It sets out the technical and health care requirements to be met in relation to the level of care provided and accounts for the changes that neonatal care has undergone over time. Level I refers to regional hospitals with maternity units, Level II refers to general hospitals, and Level III refers to reference hospitals. As this distribution can be applied to all Spanish units, we believe that our study population is representative of the whole of Spain. Hospital 12 de Octubre in Madrid has a Level IIIC NICU in which DC is routinely practiced. The first professionals to obtain NIDCAP certification commenced their training in 2005. At the end of 2011, the center was certified as a NIDCAP training center.

2.1. Course

The main objective of the course, from a theoretical and practical standpoint, was to prepare professionals to care

for newborns along DC guidelines. The topics focused on the following: control of the macro-environment (light, noise, etc.) and micro-environment (positioning, handling, and pain); promotion of family participation in the care of the hospitalized newborn, and optimization of the family's role as primary caregiver; improvement of skills and knowledge required to implement kangaroo care in the neonatal units; provision of the necessary techniques for early skin-to-skin contact in the delivery room and in Caesarean births in order to establish early bonding and the onset of breastfeeding; development of the skills and knowledge required to ensure the supply and availability of mother's milk in the neonatal unit; and emphasis of the active role of parents in all aspects relating to patient safety.

Each course was given over 4 working days (Monday through Thursday), 7 h/d, for a total of 28 hours. The methodology used was based on theoretical and participatory demonstrations provided by a variety of professionals, videos, and practical workshops using infants in the neonatal units and simulation exercises.

The following course materials were used: PowerPoint presentations, at least three of the most relevant articles on each of the areas covered by the program, information sheets on paper and in PDF format, DVDs of the videos shown, and positioning material (special nests for containment, blankets, swaddling material for kangaroo care, pacifiers for premature babies, and sound level meters). Although the instructors' presentations on each topic were always the same, slight variations were introduced if new, relevant information had been published on a particular topic.

2.2. Surveys

In order to evaluate participants' pre-course knowledge levels, an anonymous multiple choice questionnaire containing 30 questions was distributed at the beginning of the course. At the end of the course, the questionnaire was redistributed to evaluate the degree of knowledge gained (Appendix 2). Unanswered questions were marked as incorrect. A pass mark was given if at least 80% of the questions were answered correctly. The multiple choice questionnaire was based on the course content, and it was demonstrated that 100% of the material covered in the questions had been explained during the course. To ensure that the questions were comprehensible, the test was given to five resident doctors and five nurses at Hospital 12 de Octubre before it was distributed. Some changes were made in accordance with suggestions to improve clarity.

Course satisfaction was evaluated in another questionnaire (from the Lain Entralgo Agency at Hospital 12 de Octubre). Various aspects of the lectures and workshops were evaluated: technical level of course content, clarity of presentation, communication skills of instructor, didactic materials used, usefulness of course content in clinical practice, and overall score. Each of these items received a numerical score on a scale of 1 to 5, from dissatisfied to extremely satisfied (1: poor; 2: tolerable; 3: indifferent; 4: good; and 5: excellent). At the end of the questionnaire, the course was given an overall rating based

on certain items using the same numeric scale. Both this and the knowledge-based survey were anonymous but, in this survey, the profession of the respondent was requested.

2.3. Data analysis

Continuous variables are presented as mean \pm standard deviation and categorical variables as absolute and relative frequencies. Given that the questionnaires were anonymous, scores for pre- and post-course knowledge and satisfaction for the same subjects (as all 3 questionnaires were completed by the same professionals) were taken as independent data sets. Therefore, the statistical significance of the comparison of the pre- and post-course association based on the answers to the 30 questions in the multiple choice test and the summary question about improvement (overall and in relation to care level) was determined using the Chi-square or Fisher's exact tests from contingency tables.

The satisfaction levels of the different neonatal care level groups and the different professional groups were compared using analysis of variance or the Kruskal-Wallis test, as appropriate.

From the data provided by the hospitals, a linear regression model was used to compare the mean post-course score with the mean pre-course score and the overall satisfaction level. The proportion of variance explained by the regression model was quantified using the R-squared statistic. Data analysis was completed using SAS 9.3.

3. Results

All of the 20 NICUs included in the study had a 24-hour open-door policy for parents, and kangaroo care was routinely practiced in all but one. Only one of the units followed the standardized program for individualized NID-CAP care.

Of the 566 practitioners who attended the 23 courses, 99% completed the questionnaire on pre-course knowledge (560/566) and 90% completed the one on post-course knowledge (510/566). An average of 24.6 ± 7 professionals attended each course.

Table 1 shows the overall comparison of correct answers for each of the 30 pre- and post-course test questions. A significant statistical improvement was evident in the rate of correct answers in all but three questions.

Eleven percent of the professionals examined got at least 80% of the pre-course answers correct compared to 56.5% post-course, which was a significant statistical difference ($p < 0.01$). Table 2 shows the average percentage of overall correct pre- and post-course answers according to care level, as well as the average percentage of improvement after the courses. In all but one of the 20 participating hospitals, there was a statistically significant improvement in percentage of correct answers (unit 13: 73% correct pre-course answers; 81% correct post-course answers). None of the units had an average of 80% pre-course correct answers, while in all but four, there was an average of at least 80% post-course correct answers.

Table 1 Correct pre- and post-course answers given by course participants for each of the questions.

Question	Pre-course (n: 560)	Post-course (n: 510)	p
1	436 (78)	468 (92)	<0.001*
2	461 (82)	465 (91)	<0.001*
3	314 (56)	310 (61)	0.12
4	279 (50)	406 (80)	<0.001*
5	376 (67)	425 (83)	<0.001*
6	512 (91)	500 (98)	<0.001*
7	491 (88)	465 (91)	0.06
8	409 (73)	465 (91)	0.001*
9	247 (44)	446 (87)	<0.001*
10	447 (80)	469 (92)	<0.001*
11	421 (75)	450 (88)	<0.001*
12	363 (65)	419 (82)	<0.001*
13	506 (90)	492 (96)	<0.001*
14	495 (88)	470 (92)	0.04*
15	489 (87)	493 (97)	<0.001*
16	417 (74)	476 (93)	<0.001*
17	202 (36)	306 (60)	<0.001*
18	346 (62)	375 (73)	<0.001*
19	285 (51)	368 (72)	<0.001*
20	471 (84)	456 (89)	<0.01*
21	509 (91)	465 (91)	0.87
22	166 (30)	227 (44)	<0.001*
23	90 (16)	179 (35)	<0.001*
24	259 (46)	371 (73)	<0.001*
25	421 (75)	455 (89)	<0.001*
26	366 (65)	398 (78)	<0.001*
27	344 (61)	445 (87)	<0.001*
28	118 (21)	328 (64)	<0.001*
29	407 (73)	428 (84)	<0.001*
30	250 (45)	430 (84)	<0.001*

Data are presented as n (%) based on the total number of questionnaires answered pre-course (560) and post-course (510).

* $p < 0.05$.

Units 2, 4, 10, and 18 achieved 77%, 74%, 76%, and 75% correct post-course answers, respectively. In the one unit that routinely used NIDCAP care, the percentages of pre- and post-course correct answers were similar to those of other units (67% and 81%). The pre-course questions answered incorrectly by more than half of the professionals and the post-course results appear in [Figure 1](#).

The course satisfaction questionnaire was answered by 501 professionals (response rate: 88%). The distribution by profession was as follows: 55% nurses, 29% nursing assistants, and 16% doctors.

[Table 3](#) shows the average overall scores and a breakdown according to care level in those items that evaluate level of satisfaction in relation to each of the lectures and workshops. [Table 4](#) gives a breakdown of mean level-of-satisfaction scores according to participant profession. In both cases, the average scores were >4 for all items.

A comparison of the lecturers by profession revealed that the scores given to both doctor and nurse lecturers were >4 for all items. In general, the doctor lecturers received slightly higher scores and statistical significance was reached in three items: technical level (4.42 vs. 4.36; $p < 0.01$), clarity of lecture (4.47 vs. 4.39; $p < 0.01$), and communicative ability (4.46 vs. 4.38; $p < 0.01$).

Separate analyses of each of the lectures and workshops showed that the scores relating to scale of satisfaction were, again, high overall (with averages > 4 for all items and all lectures and workshops). On the scale of satisfaction, each of the lectures and workshops was given a score of >4 by $>95\%$ of the professionals (ranging between 95.5% and 99.4%). The lecture that received the lowest satisfaction score (although it did have an average > 4) was the one on patient safety (lecture 8, average general score: 4.30 ± 0.60). The lecture with the highest score was the one on NIDCAP fundamentals (lecture 17, average general score: 4.49 ± 0.55).

Linear regression analysis used to determine whether pre-course knowledge and course satisfaction could explain the improved level of knowledge after taking the course showed that both variables explain 35% of the variance (R^2 0.35). In the model which was used, bearing in mind that the questionnaires were anonymous and that we were only able to explore this correlation on a group level, not an individual level, post-course knowledge gained was significantly influenced solely by pre-course knowledge scores (β 0.499; $p < 0.001$) and not by mean satisfaction (β 0.219; $p < 0.88$).

4. Discussion

This study shows that most health care practitioners working in neonatal units in Madrid have an acceptable level of knowledge of DC, which improves significantly after taking a theoretical-practical course aimed at improving the application of DC. The study shows that pre- and post-

Table 2 Percentage of correct pre- and post-course answers and percentage of improvement.

	Overall (n-pre: 560 [†] ; n-post: 510 [‡])	Level I: 2 centers (n-pre: 41 [†] ; n-post: 37 [‡])	Level II: 8 centers (n-pre: 159 [†] ; n-post: 147 [‡])	Level III: 10 centers (n-pre: 360 [†] ; n-post: 326 [‡])
Pre-course	65	64	64	65
Post-course	81	80	83	81
Improvement	16	16	19	16
p	<0.001*	<0.001*	<0.001*	<0.001*

* $p < 0.05$.

[†] n-pre = number of health care professionals who answered the pre-course questionnaire.

[‡] n-post = number of health care professionals who answered the post-course questionnaire.

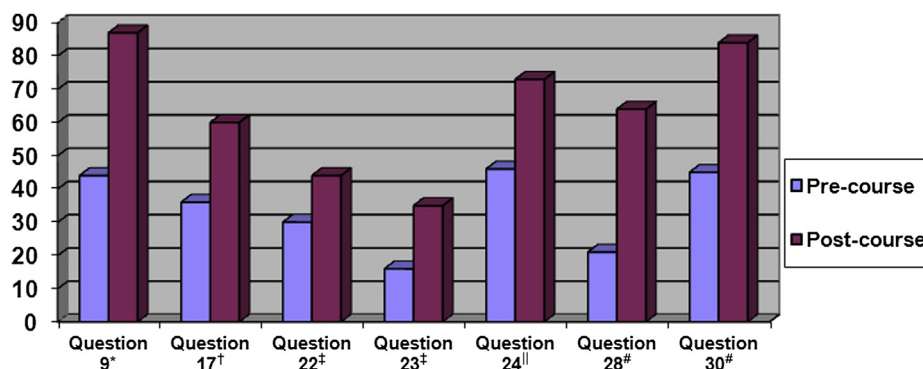


Figure 1 Comparison of percentage of correct pre- and post-course answers. The figure shows the comparison between the percentage of correct pre- and post-course answers in those questions with a rate of overall correctness <50% pre-course. Note: $p < 0.05$ when comparing percentage of pre- and post-course correct answers. * Question 9 = Errors in clinical practice. † Question 17 = Donor milk banks. ‡ Question 22 and 23 = Environmental control of light. || Question 24 = Handling and postural care. # Question 28 and 30 = Newborn Individualized Developmental Care and Assessment Program (NIDCAP) fundamentals (28, recognition of normal behavior; 30, brain maturation).

Table 3 Mean scores[†] with standard deviation of those items which evaluate lecture and workshop satisfaction.

	Overall (n = 501)	Level I (n = 34)	Level II (n = 146)	Level III (n = 321)	p
Technical level of course content	4.38 ± 0.39	4.57 ± 0.40	4.42 ± 0.42	4.35 ± 0.36	<0.001*
Clarity of presentation	4.42 ± 0.39	4.54 ± 0.39	4.47 ± 0.43	4.39 ± 0.37	<0.001*
Communication skills of instructor	4.41 ± 0.41	4.53 ± 0.39	4.44 ± 0.45	4.38 ± 0.38	<0.001*
Didactic material used	4.28 ± 0.43	4.44 ± 0.42	4.31 ± 0.53	4.24 ± 0.38	<0.001*
Usefulness of course contents in clinical practice	4.39 ± 0.40	4.47 ± 0.42	4.45 ± 0.39	4.36 ± 0.40	<0.001*
Overall score for lecture/workshop	4.39 ± 0.40	4.54 ± 0.38	4.43 ± 0.42	4.35 ± 0.38	<0.001*

* Values of $p < 0.05$ when comparing the three neonatal care levels.

† For each item, the average of the mean scores given by course participants for each lecture and workshop was calculated on a scale of 1 to 5 (1 = poor; 2 = tolerable; 3 = indifferent; 4 = good; and 5 = excellent).

course knowledge do not significantly differ according to the care level of the neonatal unit. However, it should be noted that, despite being high, course satisfaction does not appear to have an effect on the level of knowledge acquired. It appears, however, that pre-course knowledge does have a significant effect on this.

Written publications evaluating the positive impact of continuing education courses on a variety of health care issues can be found in the literature.¹⁻⁷ In general, the results show significant improvement in competence after taking a course. However, in the case of neonatology and DC in particular, we have not found any other articles evaluating these matters. This type of evaluation helps to identify the participants' basic knowledge at the outset of a course, thereby enabling comparisons. Our hypothesis at the beginning of the study was that hospitals with higher levels of neonatal care would have greater DC knowledge; however, the results proved otherwise. We found that pre- and post-course levels of knowledge were similar, regardless of care level. This may be fundamentally due to the fact that most practitioners had not had any training in DC and therefore started out with a similar level of basic knowledge. At the same time, the rate of improvement for all participants was similar, indicating the same level of

interest. This improvement was significant in all of the hospitals except one.

Furthermore, it is surprising that the only unit that applied NIDCAP care had a level of knowledge similar to that of the other units and no higher. Its improvement rate was also similar. One possible explanation for this result is that the participants in this unit who were selected for the course were primarily professionals who had not yet been trained in NIDCAP and also had less knowledge of DC in general, with the result that the course increased their level of training.

An analysis of the pre- and post-course questionnaires can help instructors to improve the course focus. Pre-course knowledge can be useful in improving the course content design and even adapting it to fit the needs of the individual center. In this case, we discovered that the questions most often answered incorrectly pre-course were those related to control of environment (2 questions), specifically lighting, and NIDCAP fundamentals (2 questions). Only one center had already introduced NIDCAP care, which could partially explain these results. In relation to lighting, the challenges around accepting a reduction in light intensity in neonatal unit environments has been noted in other studies.²³⁻²⁶ These studies show that,

Table 4 Mean scores[†] with standard deviation (based on profession) of items that evaluate satisfaction.

	Doctors (16% ^{†,‡})	Nurses (55% ^{†,‡})	Nursing assistants (29% ^{†,‡})	<i>p</i>
Technical level of course content	4.43 ± 0.40	4.35 ± 0.39	4.36 ± 0.36	0.23
Clarity of presentation	4.47 ± 0.38	4.42 ± 0.41	4.37 ± 0.36	0.15
Communication skills of instructor	4.44 ± 0.40	4.40 ± 0.42	4.36 ± 0.37	0.29
Didactic material used	4.36 ± 0.38	4.23 ± 0.46	4.24 ± 0.39	0.03*
Usefulness of course contents in clinical practice	4.46 ± 0.38	4.39 ± 0.39	4.30 ± 0.41	0.02*
Overall score for lecture/workshop	4.43 ± 0.38	4.38 ± 0.39	4.33 ± 0.40	0.20

* Values of *p* < 0.05 when comparing the three professional levels.

[†] For each item, the average of the mean scores given by course participants for each lecture and workshop was calculated on a scale of 1 to 5 (1, poor; 2, tolerable; 3, indifferent; 4, good; 5, excellent).

[‡] The percentages are based on the total number of professionals who answered the questionnaire on satisfaction (*n* = 501).

although lighting reduction has been found to have a positive effect on newborns, it leads to a certain degree of dissatisfaction among practitioners. This apparent resistance of staff towards dimming the lights seems to influence the knowledge they have or acquire about this aspect of controlling environmental stimuli. The fact that the percentage of correct pre-course answers in one of the questions on milk banks was also low could be explained by the fact that only one unit had a milk bank. Another question with fewer correct pre-course answers was related to an unspecified neonatology-related issue on clinical errors, and this could explain the results in part. Nonetheless, the percentage of correct answers to these questions also improved significantly after taking the course. The post-course questionnaire results should encourage instructors to question the methodology and course contents on this specific topic, which should ultimately lead to changes that convey the message more appropriately. In this case, it should be noted that, in relation to the three questions with no statistically significant improvement, the percentage of pre-course correct answers was very high in two, which were related to the consequences of exposure to pain and noise in the unit. The third question was related to parental and family access to the unit.

In view of the results, changes have been made to some of the course presentations with the aim of consolidating the elements that professionals know less about and the elements in which we found that the knowledge gained could be improved further, such as NIDCAP fundamentals and lighting. Courses are also currently being offered in other regions of Spain by the same instructors. In subsequent courses, we will attempt to verify whether these changes lead to improved results.

Indicators noted in the satisfaction questionnaire can help detect areas in which course improvement could lead to enhanced learning competence. In this case, the rate of satisfaction was high for all levels of neonatal care and all professional levels. It is interesting to note that the rate of satisfaction dropped as the level of care increased. This may indicate that practitioners working at higher care levels have greater course expectations. Another point to consider is the fact that the doctor participants gave higher satisfaction scores and the doctor instructors received higher scores. It will be interesting to see if these results are replicated in future studies.

As mentioned previously, studies exist that evaluate learning and satisfaction in relation to continuing education courses in different health care areas.¹⁻⁷ However, we have found very few that attempt to compare both variables. Singhal et al² used various questionnaires to evaluate a training program for health care professionals dealing with high-risk newborns. In addition to using a questionnaire on pre- and post-course knowledge and self-confidence, he also evaluated satisfaction and perceived usefulness. In this study, the perceived usefulness of the course was not correlated with the knowledge gained. In his linear regression analysis, the variance in the scores given to post-course knowledge was primarily explained by the pre-course knowledge. The data are similar to ours and support the idea that the knowledge gained following a course seems to depend more on the knowledge base with which the participant starts out rather than the rate of course satisfaction. For this reason, we believe that using the rate of satisfaction as an indirect measure of learning in continuing education courses is inappropriate.

Our study is not without its limitations. The fact that the health care professionals knew that they were being evaluated may have contributed to the observed improvement and results; therefore, the results may not be broadly applicable to other courses. Owing to the fact that the questionnaires on knowledge were completely anonymous, it is impossible to evaluate course participants' pre- and post-course levels, either individually or according to a professional group. It is also difficult to evaluate DC knowledge based on a 30 question test alone. When evaluating any educational endeavor, certain aspects must be considered: participant satisfaction, knowledge and skills acquired, change in attitude towards application of new knowledge in clinical practice, and impact on patients.^{1,8} In summary, the most important objective in any continuing education course is the transfer of new knowledge and skills to a practical situation. Although practical workshops were included in the program, our inability to evaluate this aspect in our study was its biggest limitation.

In conclusion, prior DC knowledge possessed by health care professionals in Madrid hospitals was similar, irrespective of their level of neonatal care. The course achieved significant improvement in the rate of correct answers, with similar results at all care levels, and the participants expressed a high level of course satisfaction. Analysis of the pre-test questions that were answered

incorrectly more frequently enables instructors to make improvements in this area. The post-course mistakes should help instructors reconsider the course contents or the methodology for possible modification. There does not seem to be a direct correlation between the rate of satisfaction with the continuing education course and the knowledge gained. Consequently, using this as a sole measure to evaluate learning competence may be inappropriate.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Acknowledgments

We are very grateful to all of the health care professionals from the various participating centers for their hard work and active collaboration. We would also like to express our gratitude to the instructors whose firm commitment made this study possible.

The project was financed through funding for measures towards improving the Care in Normal Birth by the Spanish Ministry of Health and Social Policy (Ministerio de Sanidad y Política Social) and was approved by the Autonomous Community of Madrid (2010) for implementation in the Strategies for the National Health System (Estrategias del Sistema Nacional de Salud) for 2010, in accordance with Royal Decree 829/201, of 25 June 2009, published in the Spanish Official State Bulletin (BOE) 166//09 in July 2009.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.pedneo.2015.04.010>.

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