



Perceived competences by graduated nurses before and during COVID-19 restrictions: A repeated cross-sectional study from 2019 to 2022

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ABSTRACT

Aims: To explore the differences, if any, in the competences perceived by newly graduated nurses who attended their education before and during the COroNa Virus Disease 19 (COVID-19) restrictions.

Background: Nursing education has undergone significant changes because of the COVID-19 restrictions. However, to date the perceived competences at the point of graduation have not been investigated over the restrictions years compared with the pre-restrictions era.

Design: A repeated cross-sectional study followed by a pseudo-panel analysis. The Strengthening the Reporting of Observational Studies in Epidemiology checklist was used. Data on individual, nursing programme and perceived competences with Nurse Competence Scale (NCS) were collected and analysed by also using a pseudo-panel approach.

Methods: Two universities were involved. Those eligible were nursing students who graduated: (1) in 2020 (=323) as the first post-COVID-19 group, who were studying in the 3rd year at the onset of the restrictions; (2) in 2021 (=250) as the second post-COVID-19 graduated group, who were in the 2nd year at the restrictions onset; and (3) in 2022 (=247) as the third post-COVID-19 group, attending the 1st year of nursing education at the onset of the restrictions. Data were compared with those who graduated in 2019 (=336, pre-COVID-19 group).

Results: The overall NCS score was higher in the pre-COVID-19 group (68 out of 100, 95 % Confidence of Interval [IC] 66.4–69.5), lower in the first post-COVID-19 graduates (62.9, 95 % CI 60–65.8), higher in the second (66.6, 95 % CI 63.6–69.4) and lower again in the third post-COVID-19 group (63.8, 95 % CI 60.9–66.5). A sinusoidal pattern also emerged for the frequency of use of the competences from the pre-COVID-19 (2.3 out of 3) and the first group (2.1) and increased between the second and the third group (from 2.1 to 2.3) ($p < 0.001$). These sinusoidal trends are also evident in the pseudo-panel analysis.

Conclusions: A different degree of perceived competences at the point of graduation emerged, with higher competences in the pre-restrictions group, lower in the first post-COVID-19 generation, higher again in the second and third group. However, all scores were over 60 points out of 100, thus indicating sufficient competences. The frequency of use of such competences slightly changed over the years with limited practical

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relevance. The findings may inform reflections regarding innovations in the clinical placements pathways as well as in the strategies supporting newly graduates nurses in their transition from education to health-care settings.

1. Introduction

As a consequence of the rapid global spread of COVID-19, on March 13th, 2020, 61 countries around the world announced the closure of schools and universities and the use of distance-learning modes (United Nations Educational, Scientific and Cultural Organization, 2020). This sudden and urgent decision introduced unprecedented challenges, especially in the field of healthcare education. Among other reasons, the uncertainty regarding the severity of the disease, the lack of the personal protective equipment (PPE) available and the likelihood of contracting COVID-19 or becoming vehicles of transmission within health-care facilities (Association of American Medical Colleges, 2020) imposed the interruption of the traditional nursing education in several countries. A new approach to education became inevitable (Dewart et al., 2020), transforming mandatory face-to-face teaching to distance learning. Several studies have investigated the effectiveness of e-learning, its advantages and disadvantages (insufficient digital competencies and equipment), developing a body of evidence (e.g., Rossetini et al., 2021) useful to design changes in the post-restrictions era.

Alongside the variations introduced in teaching, clinical education also underwent major changes. According to the European Directives (European Parliament, 2013), a minimum of 1800 h of closely supervised direct patient care is necessary to become a nurse. During the COVID-19 restrictions, this requirement was rather difficult to fulfil (O'Keefe and Auffermann, 2022): traditional clinical rotations have been replaced with online meetings, screen-oriented simulations, distance or virtualized learning experiences (Kazawa et al., 2022) or with technology-enhanced storyboarding methodologies (Roberts and Mazurak, 2021). Some researchers have investigated the number of nursing students able to carry out their clinical internship as planned, which ranged from 54.74 % to 62 % (Ulenaers et al., 2021; Rohde et al., 2022) suggesting that online education was widely used to compensate for the restrictions in clinical rotation. When possible, discontinuity in the access to hospitals due to quarantine episodes or other issues (changes in the mission of the ward), have also affected the quality of the learning process (Dziurka et al., 2022).

Studies have examined the implications of such changes (Jokar et al., 2023; Rohde et al., 2022; Ulenaers et al., 2021) on students' mental health (Comparcini et al., 2022; Curcio et al., 2022; Rodríguez-Almagro et al., 2021), learning process, personal/social life (Rohde et al., 2022) and on their intention to continue the nursing career (Rood et al., 2022). Concerns about contracting COVID-19, the lost clinical learning opportunities and the challenges involved in online learning (Fitzgerald and Konrad, 2021) were also reported. However, how all these variations in the nursing education have affected the competences expected at the point of graduation has received limited attention to date, with only three studies available: in the United States, new graduates have been documented addressing the perceived lack of competences by attending postgraduate programs to compensate for their lack of clinical education (Rood et al., 2022); Korean students exposed to alternative strategies to clinical placements (e.g. case studies, simulation) have reported a significantly increased degree of difficulties in performing tasks (Kang and Hwang, 2023); in Italy, competences achieved by a cohort of new graduates in the pre-restrictions era and those after the onset of COVID-19 have reported no statistical differences in the perceived competences at the point of graduation (Palese et al., 2022).

Confronting the competences achieved at the point of graduation over the time, comparing the pre-restrictions data with that collected in following years characterized by variations in the education offered due to the restrictions waves, has many potentialities, including:

- (a) informing the decisions regarding how to shape the transition programs supporting post new graduates to become independent registered nurses;
- (b) highlighting the potential effects of different variations as most of them were not evidence-based;
- (c) providing insights regarding the possible directions of nursing education reforms and modernization;
- (d) informing for future pandemic plans.

Therefore, the main aim of this study was to explore differences, if any, in the competences perceived by newly graduated nurses attending their education during the COVID-19 restrictions, characterized by important variations in the education pathway, compared with that perceived before the COVID-19 restrictions with the traditional nursing education. The second aim was to discover, if any, differences in the frequency of use of such competences over the groups.

2. Methods

2.1. Study design

This is a repeated cross-sectional study reported here according to the Strengthening the Reporting of Observational Studies in Epidemiology checklist (von Elm et al., 2014) (Table S1).

2.2. Setting and sample

Two universities located in the North Italy with a strong established network and homogeneous nursing programmes (Kajander-Unkuri et al., 2021) were involved. All new graduates in November 2020, 2021 and 2022 willing to participate in the study were eligible (respectively 631, 350 and 320 for each year). The recruitment was stopped around one month after graduation to prevent recall bias and to mirror the sample size achieved in the universities included in a previous survey (Kajander-Unkuri et al., 2021) performed with the same data collection tools.

2.3. Variations in nursing education

Different variations in nursing education were observed over the years compared with the pre-restrictions pathway, allowing to identify four different groups of graduates (Fig. 1):

- Pre-restrictions group, graduated in 2019: a pre-restrictions new graduates' group (hereinafter pre-COVID-19 group; Kajander-Unkuri et al., 2021) who graduated in November 2019, was firstly considered. They had been exposed to a traditional education of three years in length, with a total of 5400 hours of education and around 1800 hours in mandatory clinical practice; no online education as provided. This pre-COVID-19 data comes from a European study (Kajander-Unkuri et al., 2021) where Italy was a participant.
- First COVID-19 new graduate group, graduated in November 2020: from March 2020, when the government declared the lockdown (Consiglio dei Ministri, 2020), universities were closed, introducing extensive online methods. Consequently, students who graduated in November 2020 as the first post-COVID-19 graduated group (hereinafter, the first COVID-19 group), had mainly followed the traditional nursing education up to March 2020 when all activities were then delivered online up to graduation.
- Second COVID-19 new graduate group, graduated in November 2021 (hereinafter, the second COVID-19 group): they attended the first

year and the first semester of the second year in the traditional manner while from the second semester of the second year (March 2020) up to graduation, all educational activities (lessons, clinical rotations) were attended in a mix of modalities (presence + online).

- Third COVID-19 new graduate group, graduated in November 2022 (hereinafter, the third COVID-19 group): they attended the first year in 2019–2020 when they received nursing education online from the second semester (March 2020); they continued their education in the second and third year, with all activities (lessons and clinical rotation) delivered through a mixed approach (on-line + presence) according to the epidemiological conditions.

2.4. Data collection tool and process

From the academic year 2018/2019–2021/2022, the same data collection tool was used (Table S2). This was developed based on COVID-19 nursing education literature (Rohde et al., 2022; Palese et al., 2022), previous studies in the field (Kajander-Unkuri et al., 2021) and the experience of the research team. The tool was piloted among newly graduated nurses not eligible to participate in the survey and no modifications were suggested.

The questionnaire was composed of three sections:

Section 1: regarding personal data (such as age and gender);

Section 2: concerning clinical rotations issues and pathway at the beginning of the COVID-19 restrictions up to graduation (e.g. interruption of the internship due to quarantine or perception of safety);

Section 3: the perceived competences at the point of graduation as measured with the Nurse Competence Scale (NCS) that was firstly validated by Meretoja et al. (2004) and then found valid and reliable also in recent years (Flinkman et al., 2017; Kajander-Unkuri et al., 2021; Numminen et al., 2013). The NCS was used according to the cultural and linguistic validation provided in the Italian context (Dellai et al., 2009; Finotto and Cantarelli, 2009; Notarnicola et al., 2018) and the validity data confirmed also in a recent international study (Kajander-Unkuri et al., 2021). The NCS is divided into two parts: the first consists of 73 statements grouped into seven dimensions, where newly qualified graduates were asked to rate the degree of perceived competence using a visual analogue scale (VAS) from 0 (low level) to 100 (high level of competence); in the second part they were asked to rate the frequency

with which they used each competence in their clinical rotations (“Not Applicable” or with a Likert scale from 1 “infrequently used” to 3 “frequently used”).

In our sample, the NCS reported an internal consistency Cronbach’s α of >0.90 in all groups (pre-restrictions, first, second and third) and in both NCS parts (data available from authors).

Data collection was performed online after graduation, leaving the survey available for around one month; e-mails, text messages or calls were provided to promote participation.

2.5. Ethical issues

The Internal Review Board of Udine University approved the research protocol (Number 173/2023). Newly qualified graduates were informed regarding the aims of the study, the voluntary participation and the confidentiality of the data collected; a formal consent was provided. The permissions to use the NCS was obtained in the first study where Italian members participated (Kajander-Unkuri et al., 2021) from the developer of the scale (Prof. Meretoja) and from the copyright holder. Data collected has been stored in databases accessible only to researchers.

2.6. Statistical analysis

To describe the samples, descriptive statistics was employed (frequencies, percentages, averages, Confidence of Interval [CI] at 95 %) followed by t-test and chi-square tests.

Then, the analysis was conducted at two levels:

At the whole level, by comparing the groups exposed to different nursing education variations.

At the pseudo-panel level: as the identified groups present a cross-sectional structure (=each sample collected independently), comparing them can be misleading; thus, to enable a direct comparison, we applied the pseudo-panel methodology (Deaton, 1986), by combining the repeated cross-sectional surveys to obtain a panel-like data structure. In the pseudo-panels’ framework, the information derived from the observation of the same individuals over time (as with the newly qualified graduates in the present study) is supposed to be approximated by the information associated with stable groups of



Fig. 1. Education variations in methods of lessons and clinical rotations (online vs presence) across groups and over time. Pre-COVID-19 group, graduated in 2019. First COVID-19 group, graduated in November 2020. Second COVID-19 group, graduated in November 2021. Third COVID-19 group, graduated in November 2022.

individuals over time (cohorts). Therefore, inside of the collected sample, we searched for some prototypes of students that were observable in all groups and built a sub-sampling procedure selecting for each prototype, the same number of subjects for each group. For each student prototype and for each group, the sub-sample size corresponds to the minimum size observed over the four groups to build a sample with a balanced structure over time. Newly qualified graduates' prototypes have been identified based on predefined characteristics according to age, gender and other variables, namely the secondary diploma, the previous university and work experiences, all reported in the literature as influencing the perceived competences (Visiers-Jiménez et al., 2022). A total of 69 different prototypes of new graduates were identified and among them, 18 presented at least one observation in each group. The selection process led to a total sample size of 680 observations (170 per group) balanced with respect to age, gender and the other variable.

The ANOVA testing procedure was then adopted to check differences, if any, across groups for each NCS dimension and the frequency of use both in the whole groups and in the pseudo-panel; in contrast, differences between subsequent surveys (e.g., 2019 vs 2020) were assessed with a simple t-test procedure (R core and Psych packages).

3. Results

3.1. Participants

A total of 336 newly graduated nurses participated in the pre-COVID-19 study phase, 323 participated in 2020, 250 in 2021 and 247 in 2022 (Table 1). They were mainly female (>80 %) homogeneously across groups ($p=0.080$) with an average age of >23 years, without any statistical differences across groups ($p=0.051$). The proportion of students with previous higher education slightly decreased over the years (from 75.9 % in the first to 64.4 % in the third group) ($p=0.028$), while those with previous work experience slightly increased (from 33.9 % in the pre-restrictions up to 48 % and 47.8 % in the second and third group)

Table 1
Characteristic of participants.

Individual variables graduated in	Pre-COVID-19 group November 2019 n=336	First COVID-19 new graduate group November 2020 n=323	Second COVID-19 new graduate group November 2021 n=250	Third COVID-19 new graduate group November 2022 n=247	p-value
Age (years), mean (CI 95 %)	23.6 (23.2–23.9)	23.5 (23.1–23.8)	23.9 (23.5–24.3)	24.2 (23.7–24.6)	0.051
Gender, female, n (%)	275 (81.8)	287 (88.8)	214 (85.6)	211 (86.5)	0.080
Living with, n (%)					
With my family	-	254 (78.7)	194 (77.6)	185 (74.9)	0.118
With my boyfriend/girlfriend	-	42 (13.0)	27 (10.8)	35 (14.2)	
Alone	-	13 (4.0)	16 (6.4)	15 (6.1)	
Students/colleagues	-	0 (0.0)	6 (2.4)	6 (2.4)	
Other	-	14 (4.3)	7 (2.8)	6 (2.4)	
With Children, n (%)	-	6 (1.9)	9 (3.6)	11 (4.4)	0.193
Secondary education, n (%)					
High school	-	245 (75.9)	174 (69.6)	159 (64.4)	0.028
Technical School	-	52 (16.1)	46 (18.4)	62 (25.1)	
Professional School	-	24 (7.4)	25 (10.0)	25 (10.1)	
Foreign School	-	2 (0.6)	5 (2.0)	1 (0.4)	
Secondary school Grade (score 60–100), mean (CI 95 %)	-	79.3 (78.2–80.2)	78.8 (77.5–80.1)	78.3 (77.0–79.5)	0.516
Previous universities experience, n (%)					
None	-	253 (78.3)	187 (74.8)	179 (72.5)	0.279
Bachelor in other fields interrupted	-	43 (13.3)	37 (14.8)	31 (12.6)	
Bachelor in other fields concluded	-	21 (6.5)	21 (8.4)	27 (10.9)	
Other	-	6 (1.9)	5 (2.0)	10 (4.0)	
Previous work experience, n (%)	114 (33.9)	135 (41.8)	120 (48.0)	118 (47.8)	0.001
Final grade ^a , mean (CI 95 %)	-	103.4 (102.6–104.2)	104.4 (103.6–105.2)	102.1 (100.9–103.3)	0.004

CI= Confidence Interval; COVID-19= COroNaVirus Disease 2019; -- data non collected.

^a Final grade obtained at graduation: from 60 (minimum) to 110 (maximum) cum laude.

($p=0.001$). The final grade obtained was slightly decreased across groups (103.4 out of 110 in the first group to 102.1 in the third group) ($p=0.004$).

In the pseudo-panel group (Table S3), including only 170 participants from each group, data regarding the individual characteristics were homogeneous a part of the academic activities followed at the time of the COVID-19 onset and the number of clinical placements before and after the onset, all reporting statistical differences across groups, reflecting the variations in the nursing education received.

3.2. Clinical learning from the COVID-19 onset to graduation

As reported in Table 2, while the first group attended most clinical rotations before the COVID-19 onset (5.1 rotations, CI 95 % 4.9–5.2), the third group attended nearly all placements after the it (7.5, CI 95 % 6.7–8.2), ($p < 0.001$).

From the outbreak of COVID-19 to their graduation, students spent from 9.4 (95 % CI 8.7–10.1; first group) up to 40.6 weeks (95 % CI 34.2–47; third group), ($p < 0.001$) in practice and in remote clinical rotations from 2.6 (95 % CI 1.8–3.4, second group) to 4 weeks (95 % CI 3.4–4.6, first group), ($p=0.021$). More than 50 % of students, homogeneously across groups, were not allowed to access COVID-19 units; moreover, they were mainly supervised by a clinical nurse (>80 % in the second and third group) and by the entire staff in the first group (19.2 %), ($p < 0.001$).

Over the years, an increased proportion of students were interrupted in their rotations due to contagion from 6.5 % (first) to 24.4 % (second) up to 46.5 % (third group), ($p < 0.001$). However, their perceived safety in doing clinical placements was high/very high and homogeneous across groups ($p=0.204$). In contrast, their perceived preparedness to deal with the clinical placements increased from 79.6 % (high/very high, first group) to 94.8 % and 95.4 %, for the second and third groups, respectively ($p < 0.001$).

The first group were from highly/to very highly satisfied with how

Table 2
Participants and the COVID-19 outbreak: clinical experiences from the COVID-19 onset up to graduation.

Clinical placements from COVID-19 onset (March 2020) to graduation	First COVID-19 new graduate group November 2020 (n=323)	Second COVID-19 new graduate group November 2021 (n=250)	Third COVID-19 new graduate group November 2022 (=247)	p-value
Clinical placements, number, mean (CI 95 %) up to the COVID-19 outbreak onset	5.1 (4.9–5.2)	3.0 (2.8–3.2)	0.5 (0.3–0.6)	<0.001
Clinical placements, number, mean (CI 95 %) after the COVID-19 outbreak onset	1.9 (1.6–2.1)	6.3 (3.0–9.5)	7.5 (6.7–8.2)	<0.001
Clinical experiences attended				
At the ward level, weeks (CI 95 %)	9.4 (8.7–10.1)	24.7 (22.5–26.7)	40.6 (34.2–47.0)	<0.001
On distance, weeks (CI 95 %)	4.0 (3.4–4.6)	2.6 (1.8–3.4)	3.8 (2.9–4.6)	0.021
Units/hospitals attended, n (%)				
Never caring for COVID+ patients	293 (90.7)	76 (30.4)	27 (10.9)	<0.001
Caring for COVID+ patients	30 (9.3)	174 (69.6)	220 (89.1)	
Restrictions to access some units with COVID+ patients	189 (58.5)	128 (51.2)	146 (59.1)	0.130
Preceptorship model, n (%) I was supervised by				
a clinical nurse	229 (70.9)	215 (86.0)	214 (86.6)	<0.001
the nursing staff	62 (19.2)	14 (5.6)	16 (6.5)	
the head nurse	6 (1.9)	8 (3.2)	0 (0.0)	
and a clinical nurse				
the nurse teacher	5 (1.5)	1 (0.4)	0 (0.0)	
the head nurse	0 (0.0)	1 (0.4)	1 (0.4)	
a clinical nurse	21 (6.5)	11 (4.4)	16 (6.5)	
and the nurse teacher				
Interruptions for quarantine				
Yes, for COVID+ cases among patients'/health care workers, n (%)	11 (3.4)	41 (16.4)	68 (27.5)	<0.001
Yes, for COVID+ cases among out of hospital contacts, n (%)	10 (3.1)	20 (8.0)	47 (19.0)	
Contagion, n (%)				
Yes, during my clinical placements	1 (0.3)	12 (4.8)	29 (11.7)	<0.001
Yes, at home	14 (4.3)	44 (17.6)	109 (44.1)	
I don't know (I was not tested)	40 (12.4)	11 (4.4)	13 (5.3)	
No, never	268 (83.0)	183 (73.2)	96 (38.9)	
Perceived safety, n (%)				
Not at All	3 (0.9)	0 (0.0)	0 (0.0)	0.204
Very Little	21 (6.5)	16 (6.4)	20 (8.1)	
Somewhat	172 (53.3)	152 (60.8)	135 (54.7)	

Table 2 (continued)

Clinical placements from COVID-19 onset (March 2020) to graduation	First COVID-19 new graduate group November 2020 (n=323)	Second COVID-19 new graduate group November 2021 (n=250)	Third COVID-19 new graduate group November 2022 (=247)	p-value
To a Great Extent Perceived	127 (39.3)	82 (32.8)	92 (37.2)	
preparedness to deal with the clinical rotation, n (%)				
Very Low	11 (3.4)	1 (0.4)	0 (0.0)	<0.001
Low	55 (17.0)	12 (4.8)	11 (4.4)	
High	174 (53.9)	158 (63.2)	163 (65.9)	
Very High	83 (25.7)	79 (31.6)	73 (29.5)	
Nursing Programme degree of satisfaction regarding the COVID-19 outbreak management				
Very Low	11 (3.4)	7 (2.8)	1 (0.4)	<0.001
Low	76 (23.5)	26 (10.4)	29 (11.7)	
High	198 (61.3)	179 (71.6)	178 (72.1)	
Very High	38 (11.8)	38 (15.2)	39 (15.8)	

CI= Confidence Interval; COVID-19= CORonaVirus Disease 2019.

the nursing program managed the COVID-19 outbreak (73.1 %), a proportion that significantly increased in the second (86.8 %) and third (87.9 %) groups (p <0.001). In the pseudo-panel group (Table S4), only aspects related to the clinical placements reported statistical differences, reflecting the differences that emerged at the overall level.

3.3. Competences perceived and frequency of use

The overall NCS score (Table 3) was higher in the pre-COVID-19 group (68 out of 100, 95 % CI 66.4–69.5), lower in the first-COVID-19 group (62.9, 95 % CI 60–65.8), higher in the second (66.6, 95 % CI 63.6–69.4) and lower again in the third-COVID-19 group (63.8, 95 % CI 60.9–66.5) (p=0.012). Statistical differences emerged in all dimensions, except for ‘Helping role’, ‘Teaching-coaching’ and ‘Ensuring quality’, which reported homogeneous scores. The frequency of use was also different, with a higher frequency in the pre-COVID-19 group (overall 2.3, 95 % CI 2.2–2.3), lower in the first-COVID-19 group (2.1, 95 % CI 2.0–2.1), slightly higher in the second (2.2, 95 % CI 2.1–2.2) and in the third (2.3, 95 % CI 2.2–2.3) (p <0.001). In all dimensions, the frequency was statistically different, except for ‘Ensuring quality’, where the frequency of use was homogeneous (p=0.151). When comparing groups, statistical differences emerged between the pre-restrictions vs the first group and pre-restrictions vs the second group, both in the overall competences scores and in the frequency of use (p <0.001). Overall competence was also significant in the comparison between the pre-restrictions and third group (p <0.001); in contrast, no statistical differences emerged between the remaining groups (Table 4).

In the pseudo-panel (Table S5), the overall NCS score was 67.5 out of 100 (95 % CI 65.3–69.6) in the pre-restrictions group, 62.8 (95 % CI 58.6–66.9) in the first-, 66.8 (95 % CI 63.5–70.1) in the second and 63.2 (95 % CI 59.7–66.5) in the third group (p=1.000). Namely, self-perceived competences were statistically different only in the ‘Diagnostic Function’ (p=0.018) and in the ‘Therapeutic Interventions’ (p=0.025) competences. The frequencies of use decreased from the pre-COVID-19 and first group (from 2.3 to 2.1, on average) and increased between the second and the third group (from 2.1 to 2.3) (Table S5) (p <0.001).

Table 3
Nurse Competence Scale of new graduated before and during COVID-19 outbreaks.

NCS dimensions and frequency of use Graduated in	Pre COVID-19 group November 2019	First COVID-19 group November 2020	Second COVID-19 group November 2021	Third COVID-19 group November 2022	ANOVA
Items, score*, mean (CI)	n=336	n=323	n=250	n=247	p-value
Helping Role	72.2 (70.6–73.6)	67.9 (65.0–70.8)	70.6 (67.7–73.5)	68.3 (65.5–71.0)	0.051
Frequency of using competency**	2.5 (2.4–2.5)	2.2 (2.1–2.2)	2.3 (2.2–2.3)	2.4 (2.3–2.4)	<0.001
Teaching-Coaching	67.1 (65.4–68.8)	62.7 (59.7–65.7)	65.5 (62.5–68.4)	63.2 (60.3–66.0)	0.053
Frequency of using competency	2.2 (2.1–2.2)	2.1 (2.0–2.1)	2.1 (2.0–2.2)	2.2 (2.1–2.2)	<0.001
Diagnostic Functions	70.2 (68.4–71.9)	63.6 (60.6–66.5)	66.3 (63.2–69.2)	63.9 (60.9–66.9)	0.001
Frequency of using competency	2.4 (2.3–2.4)	2.2 (2.1–2.2)	2.2 (2.1–2.3)	2.3 (2.2–2.3)	<0.001
Managing Situation	70.2 (68.4–72.0)	63.5 (60.5–66.4)	67.5 (64.5–70.5)	64.8 (61.8–67.6)	0.001
Frequency of using competency	2.4 (2.3–2.4)	2.2 (2.1–2.2)	2.2 (2.1–2.3)	2.3 (2.2–2.3)	<0.001
Therapeutic Interventions	66.0 (64.1–67.7)	59.2 (56.2–62.2)	63.0 (59.8–66.1)	59.9 (56.8–62.9)	0.001
Frequency of using competency	2.3 (2.2–2.3)	2.1 (2.0–2.1)	2.1 (2.0–2.1)	2.1 (2.1–2.2)	<0.001
Ensuring Quality	63.7 (61.7–65.7)	62.4 (59.3–65.5)	67.5 (64.4–70.6)	62.5 (59.5–65.5)	0.054
Frequency of using competency	2.1 (2.0–2.1)	2.1 (2.0–2.1)	2.1 (2.0–2.1)	2.2 (2.1–2.2)	0.151
Work Role	68.1 (66.2–69.8)	62.9 (59.8–65.8)	67.2 (64.2–70.2)	64.0 (61.0–66.9)	0.013
Frequency of using competency	2.3 (2.2–2.3)	2.1 (2.0–2.2)	2.2 (2.1–2.2)	2.3 (2.2–2.3)	0.003
Overall Competence	68.0 (66.4–69.5)	62.9 (60.0–65.8)	66.6 (63.6–69.4)	63.8 (60.9–66.5)	0.012
Frequency of using competency	2.3 (2.2–2.3)	2.1 (2.0–2.1)	2.2 (2.1–2.2)	2.3 (2.2–2.3)	<0.001

CI= Confidence Interval; COVID-19= CoronaVirus Disease 2019; NCS= Nursing Competence Scale.

* The NCS, at the competency level, is measured by a Visual Analog Scale, where 0 indicates a very low level and 100 indicates a high level of competency.

** The frequency of using the competences increased from 'very seldom' (=1) to 'occasionally' (=2) and to 'very often' (=3).

Table 4
Nurse Competence Scale of new graduated before and during COVID-19 pandemic.*.

NCS Dimensions and frequency of use	Single testing procedures, p-values					
	Pre COVID-19 vs First COVID-19 group	Pre COVID-19 vs Second COVID-19 group	Pre COVID-19 vs Third COVID-19 group	First COVID-19 vs Second COVID-19 group	First COVID-19 vs Third COVID-19 group	Second COVID-19 vs Third COVID-19 group
Helping Role	0.006	0.253	0.011	0.200	0.763	0.303
Frequency**	<0.001	<0.001	0.004	0.017	<0.001	0.159
Teaching-Coaching	<0.001	0.004	<0.001	0.196	0.835	0.270
Frequency **	<0.001	0.003	0.176	0.621	0.028	0.118
Diagnostic Functions	<0.001	0.022	<0.001	0.212	0.997	0.220
Frequency**	0.001	0.016	0.510	0.426	0.018	0.121
Managing Situation	<0.001	0.015	<0.001	0.059	0.546	0.194
Frequency**	<0.001	0.009	0.097	0.132	0.010	0.341
Therapeutic Interventions	<0.001	0.004	<0.001	0.092	0.908	0.119
Frequency**	0.019	0.164	0.356	0.485	0.197	0.617
Ensuring Quality	0.032	0.653	0.033	0.024	0.956	0.025
Frequency**	0.242	0.855	0.577	0.386	0.111	0.504
Work Role	<0.001	0.018	<0.001	0.050	0.524	0.188
Frequency**	0.006	0.075	0.526	0.492	0.053	0.264
Overall Competence	<0.001	<0.001	<0.001	0.093	0.678	0.222
Frequency**	0.001	0.001	0.093	0.856	0.159	0.131

COVID-19= CoronaVirus Disease 2019; NCS= Nursing Competence Scale.

* for data see [Supplementary Table 5](#)

** of using the competency

When comparing groups, statistical differences emerged between the overall NCS scores obtained by the pre-restrictions and the first group ($p=0.002$) and by the pre-restrictions and the third group ($p=0.002$), while the frequency of use was significantly different only between the pre-restrictions, the first and second group ($p=0.038$; $p=0.007$), respectively ([Table S6](#)).

4. Discussion

4.1. Participants

Although several studies measuring the work preparedness have been published also recently as also measuring the competences achieved during the restrictions (e.g. [Sternier et al., 2023](#)), to the best of our knowledge, this is the first investigation comparing the perceived competences of four different cohorts of students at their point of graduation, from the pre-restrictions era to the most recent. In our study,

participants were slightly older than those involved in the pre-restrictions group; despite the average age being substantially in line with national data ([AlmaLaurea, 2022](#)), the mild increase observed may suggest the willingness to enter nursing education later compared with the past (from 19 years old to 21) or some difficulties in ending the course on time due to restrictions imposed by the restrictions requiring more time to achieve all expected competences ([Ramos-Morcillo et al., 2020](#)).

The female/male ratio was homogeneous over the groups but higher than that documented at the national level at 76 % ([Federazione Nazionale Ordini Professioni Infermieristiche, 2022](#)), likely due to the stronger attitudes among females to participate in surveys ([Smith, 2008](#)) and for their greater drive due to personal interests ([Maurud et al., 2022](#)). Moreover, a progressively decreasing number of students with scientific-based secondary education has been traced over the years, in line with national trends ([AlmaLaurea, 2022](#)), suggesting a more technical- and professional-oriented prior education in recent years

compared with that of the past. This may have influenced the perceived competences according to the different attitudes and prerequisites gained in the precedent education. The final grade has slightly decreased over the years, with minimal impact given that the differences range between one or two points out of 100; however, this may suggest a lower overall performance that should be monitored in the future.

4.2. Clinical learning variations from the COVID-19 onset to graduation

The variations applied in nursing education from 2020 to 2022 were important, different in the solutions, times and intensity over the years, according to the resources available (PPE, vaccination), the restrictions trends and the overall rules regarding the role of students in the health-care settings (Bassi et al., 2023). These variations affected from only one semester (first COVID-19 group) to half (second group), up to the entire three years in the case of students just enrolled in nursing education at the onset of COVID-19. No similar variations have been reported in the nursing education globally before the COVID-19 restrictions, with students attending around one month of clinical placements online or facing several interruptions when attending in person. Substituting clinical rotations (Kang and Hwang, 2023) with online discussions under the guide of a nurse educator may have encouraged students' engagement and a sense of preparedness. However, around 20 % of students perceived themselves as being unprepared to deal with the clinical rotations, a concern that has ameliorated over the years, likely because of the positive trend of the restrictions on the one hand and the process of normalization to the situation on the other. The rapid changes in healthcare protocols, the overwhelming caseloads and the need to adapt to rapidly evolving circumstances (McMillan et al., 2023) may have contributed to these different feelings of unpreparedness over time.

Over the years, an increased occurrence of students reporting interruptions in their clinical placements due to infections have emerged. This information may enrich the epidemiological data and inform the future restrictions plans about students' risk. However, compulsory absences due to illness and quarantine may have further affected the competence development, as offering additional clinical internships was not always possible.

The preceptorship model has also changed, increasing the supervision provided by a clinical nurse, through the identification of a single practitioner who followed each student throughout the clinical training and limiting that offered by the nursing staff, composed of all nurses working in the unit offering a more heterogeneous guide and supervision. Limiting contacts to ensure their traceability and maximizing clinical learning were the main aims of this supervision model. However, the socialization and integration process shaping the professional identity may have been negatively affected due to the limited exposition to the staff (Dziurka et al., 2022).

In addition, the pre- and first-COVID-19 groups learnt mainly in the pre-restrictions world, characterized by some restrictions in accessing units; with wards opened to families and supervision delivered mainly by the entire staff. In contrast, the second and third COVID-19 groups learnt mainly in the post-restrictions era in non-COVID-19 units, supervised by one nurse, where no family were allowed and the contact with patients was also limited or prevented with several barriers (masks, PPE). Discovering the long-term effects of this different exposure (e.g., family engagement attitudes) will be important.

4.3. The perceived competences

Both at the overall level and in the pseudo-panel analysis, a sinusoidal curve emerged: higher competences were perceived by the pre-restrictions group, with a collapse of them observed in the first COVID-19 group who graduated in 2020; there was an increased perception in the second group, graduated in 2021, similar to that reported in the pre-restrictions era and a collapse again in the third group who graduated in 2022. Significant differences emerged in some

competencies ('Diagnostic Function', 'Therapeutic Interventions'). This sinusoidal trend is also evident when groups are compared in pairs: from the pre- to the first-COVID-19 group, a major decrease in the perceived competencies has been observed, less between the pre- with the second-COVID-19 group and higher again with the third group. By comparing only those exposed to the variations applied during the restrictions, the same sinusoidal trend emerged with significant differences only in some competencies. Overall, those students attending the first and third years of education during the restrictions onset have reported a decreased level of competence at the point of graduation. In contrast, those attending the second year perceived their competence as near to the pre-restrictions group. The probability of catching up on missed learning opportunities varied among the groups according to the length of time from the start of COVID-19 to graduation. Moreover, in all groups, self-assessed competences constantly scored above 60 out of 100, suggesting a sufficient level. While experiencing the important variations in the clinical rotations, students may have learnt the value of each singular learning occasion as precious thus maximizing the impact on the competences gained. Moreover, the one-to-one supervision may have increased the competences acquired, while the online surrogates may have facilitated the preparation for the clinical practice.

However, the findings that emerged may be interpreted from different perspectives.

At the restrictions onset, third-year students were substantially refining their competences and their lack of confidence in their preparation may be due to the difficult clinical environments triggering fear, insecurity and uncertainty regarding how actualized the competences possessed. A significant factor that may have played a role is also the growing awareness of the impending transition to the responsibility of patient care. This awareness could have triggered a sense of apprehension as they were confronting the weight of the responsibilities ahead (Hampton et al., 2021). Findings may also be justified by the fact that newly graduates were confronting the stark reality showing that, despite their years of study, there is still much to learn, resulting in feelings of inadequacy or fear of the unknown (Opoku et al., 2020). Moreover, the transition to the profession responsibilities represents a crucial point of introspection, where graduates confront the gap between their current knowledge and the competencies required by the professional world. Furthermore, these graduates, strongly welcomed by the health-care services to compensate for the dramatic nursing shortages, may have felt unprepared to enter immediately in the workplace (Swift et al., 2020).

In contrast, first-year students who graduated in 2022, did not enter the clinical settings at the time of the COVID-19 onset; their clinical rotation was substituted with online education and placements started substantially in the second year, characterized by several interruptions, continuously adjusting their mission (e.g. from the so called 'non-COVID' to 'COVID wards') and nurse supervisors were often deployed from one unit to another (Rohde et al., 2022) thus unavailable (Head et al., 2022). In other words, the fundamental bases provided by the clinical placements usually provide in the first year was missed. The compression of all placements in the following years may have generated a lack of confidence in the competence gained, as also underlined by Rohde and colleagues (2022); additionally, their clinical placements were experienced in a 'surreal' world where not all competences have been trained. In contrast, second-year students at the onset of COVID-19 and graduated in 2021, developed the fundamental competences in the pre-restrictions period and in the traditional manner; this may have given them a solid basis on which to build the remaining competences in the second and third years by shaping and adapting their learning process to the complex situation.

A sinusoidal pattern also emerged for the frequency of use. However, despite the significant differences that emerged at the overall and the pseudo-panel level, two main observations may be derived: first, both in the pre-restrictions and in the following groups, the frequency of use of all competences was, on average, 'occasionally'. No dramatic deflection

in the occurrence of competences was recorded during the restrictions, suggesting that students were allowed to practice themselves as previously. Secondly, the different perceived competences reported across groups seems to not be influenced by the use of them given the frequencies are in line with those reported in pre-restrictions times in international studies (Kajander-Unkuri et al., 2021): this seems to suggest interesting lines of investigations regarding both the hours spent in the practice and the number of times that one task should be exercised to develop the competencies.

4.4. Limitations and strengths

The study has several limitations. First, we used a database from a pre-COVID-19 cohort, where data collected were in line with the study design (Kajander-Unkuri et al., 2021), thus not allowing a full comparison with the COVID-19 cohorts. Moreover, we collected data over the years, establishing a predefined sample size and when to end the data collection and this may have introduced a selection bias. Furthermore, the NCS has been developed in pre-restrictions years: thus, it may not be able to capture the additional competences required but not experienced, or others developed by students during the restrictions instead of those traditionally expected. Moreover, competences have been described as perceived by graduates and not as observed; the concept of work readiness has been investigated in the literature by also validating tools (Kim and Shin, 2022). In addition, no other statistical analysis was conducted regarding the influence of other variables in the competencies perceived while results may have been influenced by them. However, the findings emerged bring out a useful insight of how the restrictions has affected the competences perceived, helping to design actions to fill educational gaps through post-graduate training and plans to face vast disasters modifying the traditional nursing educational pathway.

5. Conclusion

The restrictions has forced unprecedented changes in the history of nursing education on a large scale. These have generated a different degree of perceived competences at the point of graduation with a sinusoidal trend, with higher competences in the pre-restrictions group, lower in the first post-COVID-19 generation, higher again in the second and third group and scores all remaining over 60 points out of 100, thus indicating sufficient competences. The frequency of use of such competences slightly changed over the years but with limited practical relevance.

At the overall level, the variations in the nursing educations mainly represented by a reduced number of hours spent in practice, the surrogate role of the online education and the changes in the students' supervision, seems to have not substantially changed the perceptions of the competences at the point of graduation. Students may have learnt the value of the hours spent in practice and the value of each singular learning occasion as precious. The one-to-one supervision may have maximized the competences acquired, while the online surrogates may have facilitated the preparation for the clinical practice. However, findings suggest that there is a need to investigate the effects of these variations in nursing education also in long terms with the following cohorts completely educated in the post-restrictions era. More data may inform decisions regarding (a) the future educational plans in case of collective disasters, (b) the training that should be provided in the transition phase (from student role – to newly graduated and clinical nurse role with care responsibilities), as well (c) the innovations that can be promoted in the nursing education.

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CRedit authorship contribution statement

Sara Dentice: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Stefania Chiappinotto:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Anna Brugnolli:** Writing – review & editing, Supervision, Project administration, Methodology, Data curation, Conceptualization. **Alvisa Palese:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Data curation, Conceptualization. **Satu Kajander-Unkuri:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Luca Grasseti:** Writing – review & editing, Software, Methodology, Formal analysis, Data curation.

Declaration of Competing Interest

None

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.nepr.2024.104019.

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