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The impact of pandemic restrictive visiting policies on infant wellbeing in a NICU

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BACKGROUND: Given the countrywide lockdown in the first pandemic period and the respective Hospital restrictive policies, we aimed to investigate if the SARS-COV-2 pandemic was associated to a reduced parental presence in the NICU and in which form this had an impact on infant wellbeing.

METHODS: Retrospective cohort study about altered NICUs parental presence (measured by number of visits and kangaroo care time) due to pandemic restrictive policies and its impact on infant wellbeing (measured through The Neonatal Pain Agitation and Sedation scale and nurses' descriptive documentation).

RESULTS: Presence of both parents at the same time was significantly lower during pandemic. Contrary, maternal presence only and total kangaroo-care time were higher within the pandemic (163.36 ± 94.07 vs 122.71 ± 64.03; $p = 0.000$). Lower NPASS values were documented during the lookdown (1.28 ± 1.7 vs 1.78 ± 2.2; $p = 0.000$).

CONCLUSION: Data collected through the pandemic confirm the importance of parental presence for infants' wellbeing in a NICU setting.

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IMPACT:

- Parental support is an extremely important aspect for infants hospitalized in an intensive care unit. Their presence was limited in many NICUs worldwide during the SARS-COV-2 pandemic.
- This study confirm the importance of parental presence for infants' wellbeing also in a pandemic situation. Our results support a family-centered newborn individualized developmental care approach in the NICU.

INTRODUCTION

At March 2020, after more than 20,000 confirmed cases worldwide and almost 1000 deaths in Europe, a pandemic due to a new type of coronavirus (SARS-COV-2) was officially announced.[1] Precise guidelines were provided for the population promoting social distancing, in order to limit human-to-human transmission.[2,3]

To protect hospitals from the spread of the virus, different guidelines were implemented including very restrictive visiting policies.[3] In this context, also neonatal intensive care units (NICUs) worldwide reduced parental visits on the assumption that this measure was necessary for the protection of patients and staff.[4] However, even considering that human contact is relevant in every clinical situation, especially neonates and infants demand the presence of their parents for their development and wellbeing.[5] A growing body of literature suggests that hospitalized infants may thrive best from consistent parental care in a family integrated setting.[5–8] Parental presence in the hospital leads amongst others to more stable physiological responses, improved oral feeding, and reduced length of stay.[5,7,8] According to Newborn Individualized Developmental Care and Assessment Program (NIDCAP) guidelines, Kangaroo care (skin-to-skin care) is essential especially during the first weeks of life, in order to facilitate bonding between parents and infants.[9] Therefore, NIDCAP Federation International (NFI) recommended parental presence and active participation to infant care at the beginning of the pandemic.[10,11]

Nevertheless, restrictive measurements for parents were applied in NICUs in many countries worldwide as well as in Austria during the COVID-19 pandemic. In our institution, the intention was from the very beginning to allow parental contact throughout all phases of the pandemic, however, visiting guidelines had to be adapted to the new situation.

Our goal was to contextualize the effect of the new visiting policies on infant's wellbeing in our neonatal wards. The hypothesis underlying this study was that the restrictive visiting policy could have had a negative impact on the quality and quantity of parental visits and kangaroo time, which in turn may have adversely influenced the wellbeing of neonates in the hospital setting.

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MATERIALS AND METHODS

Design

This is a retrospective data analysis conducted at the Medical University of Vienna after approval of the local ethics committee (1504/2020), comparing patients hospitalized in our NICUs during the first lockdown period (March 15 and June 1 2020) with a historical cohort of the same time period of the previous year. The study focuses on infants born <32 weeks of gestation in order to increase groups homogeneity and comparability.

During the considered time-period, no SARS-CoV-2 positive mothers and/or infants were admitted to our hospital, so that our results only refer to general restrictive measures concerning all admitted infants and parents, not to infected mother and infant dyads.

Setting

The Department of neonatology of the Medical University of Vienna is a level three perinatal center. It consists of 54 beds dedicated for neonatal care, admitting 180–200 very low birth weight infants per year. The care concept for our patients is individualized, and family-centered.

Restrictive visiting policies

Before the pandemic we had an open visiting policy of 24 h for parents. During the first lockdown only one parent, if asymptomatic, was allowed to visit his/her baby once a day (except for critical clinical or palliative situations). Once parents left the hospital, they were not allowed to return on the same day. In case of suspected COVID-19 infection, following the same rules as for the rest of the Austrian population, parents were not allowed to leave their home until a negative official PCR test result was available. The use of face masks was obligatory for both parents and medical staff. In general, access to the hospital was very restrictive, with separate entrances for staff and visitors, each of whom strictly controlled by triage teams. Medical staff was organized in dedicated teams, promoting home office in order to reduce the number of daily visits to the clinic. Two senior medical doctors and two senior fellows per ward rotated every week between in-hospital-presence and home-office, avoiding contact between different teams in order to preserve clinical care also in the event of outbreaks. The number of nurses working at the wards during day and night was unchanged to the situation before the lockdown.

Data collection

Data were extracted from the Patient Data Management System (PDMS) provided by PHILIPS (IntelliSpace Critical Care and Anaesthesia (ICCA)© – Philips clinical healthcare), and from discharge letters. The computerized documentation system provides not only flow-sheet, monitoring data, open and standardized reports, but also several drop-down menus with multiple-choice items useful to describe relevant procedures in the NICU. Patient monitor data are continuously transferred to the PDMS. Manual data documentations are structured at interface with pick-lists and specific input sets to prevent errors. Quality control of electronical transfer contains value ranges, validation, approval and double patient checks. Patient medical data export was done with standard MS SQL-Server tools. Exported patient data was stored in specially designed MS-Excel tables for the study. An extra quality control of the exported data was done during the export including procedures like cross checks and handling of missing data. The following data were considered: days of hospitalization and total number of patients admitted per day; descriptive characteristics such as birth weight and gestational age; rates of intraventricular hemorrhage (IVH), periventricular leukomalacia (PVL), retinopathy of prematurity (ROP), necrotizing enterocolitis (NEC), sepsis, bronchopulmonary dysplasia (BPD), congenital malformations, and surgery.

Parental presence was extrapolated from the computerized patient system in terms of visiting episodes and total-time on Kangaroo-care.

Patients' wellbeing was documented through the Neonatal-Pain, Agitation and Sedation Scale (NPASS), and descriptive reports of the nurses (e.g., excessive cry). The NPASS[12] includes five criteria (crying-irritability, behavior state, facial expression, extremities tone, vital signs) graded 0 to 2. The total score results from adding the scores for each criterion. Scores above 5 (up to a maximum of 10) indicate agitation/pain.[13]

Finally, information about routine clinical investigations, invasive procedures and mode of ventilatory support were extracted.

Statistics

Statistics was performed using SPSS statistics for Windows version 21.0 (Armonk, NY: IBM Corp.) and Microsoft Excel (Excel version 2007). Quantitative data is represented as a means ± standard deviation (SD), while qualitative data is displayed as counts and percentages. A *t*-test was used to compare continuous variables across the two groups, while a chi-square test was used to compare categorical variables. To compare two timelines (March 2019–June 2019 Vs March 2020–June 2020) with different numbers of patient-per-day, we adjusted the number of daily information on the total number of patient-per day, considering one unit of measure per patient-day (e.g., maximal NPASS scored in a day).

RESULTS

A total number of 146 patients were admitted to our NICUs during the study period (15 March–1 June 2020), compared to 176 patients during the same period 2019, further referred to as the "no_lockdown period" (15 March–1 June 2019). The total number of patient-days for the entire period was 3044 (lockdown) and 3170 (no_lockdown), respectively. The total number of patient-days for the entire period for infants born below the 32 weeks of gestation was 2489 (lockdown) and 2191 (no_lockdown). As also shown in Fig. 1 a focus was hold on premature infants with low birth weight, particularly in the first phase of the lockdown (Fig. 1).

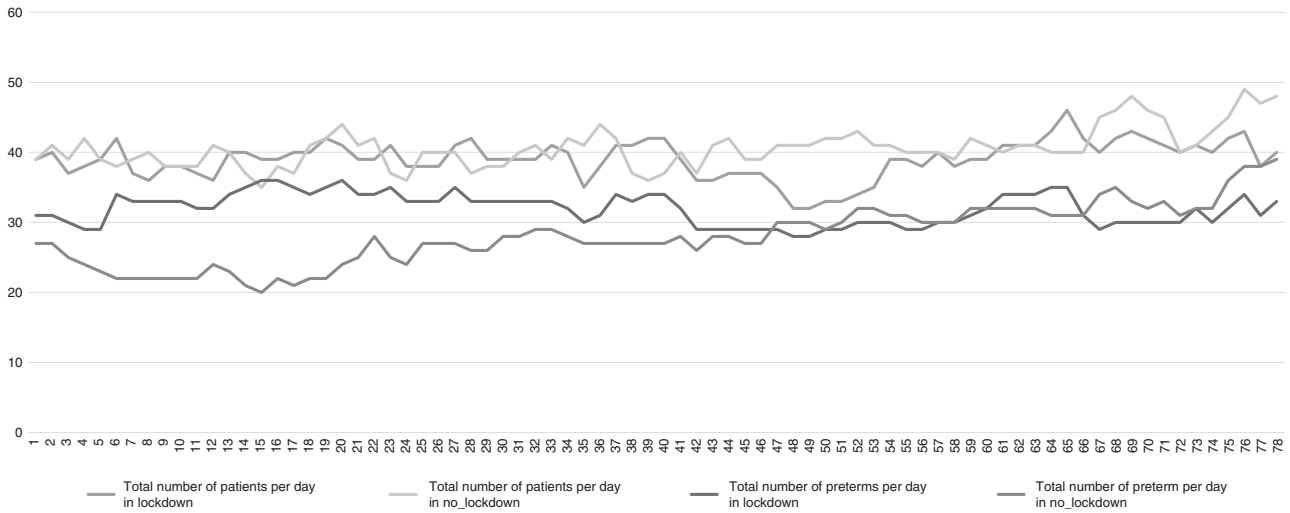
A birth weight <750 g was often documented in the lockdown period (273 observation in the timeline considered, 10.93%) compared to the no_lockdaown period (145 observation in the timeline considered, 6.62%).

Infants were comparable for descriptive characteristics and no substantial differences were found between the groups for the most important neonatal morbidities, except for sepsis showing a lower rate during the study period ($p = 0.002$) (Table 1).

As dictated by the new visiting policy, visits were largely limited to one parent at a time in the lockdown-period, whereas both parents together were seen more often in the no-lockdown period ($p = 0.000$) (Table 2, Fig. 2). Unexpectedly, maternal presence as well as total daily time spent on kangaroo-care were significantly higher during the lockdown period compared to the no_lockdown period ($p = 0.000$) (Table 2; Fig. 2; Supplementary eFig. 1). Further, presence of grandparents and other family related persons was very limited during the lockdown, having only 25 visits episodes during the lockdown period compared to the 320 documented visits episodes in the no_lockdown period.

One-thousand-six-hundred-ninety-five NPASS assessments were documented during the lockdown period vs 1590 in the no_lockdown period. The majority of scores were in a normal range (92.04% in lockdown vs 88.74% in no_lockdown) (Supplementary eFig. 2). Moreover, more observations of pain/agitation were reported in the no_lockdown period (11.26%) compared to the lockdown period (7.96%) (Supplementary eFig. 2). When normalizing these percentages on the patients' time line, having 8.17% of pain/agitation observations during the no_lockdown period vs 5.40% of observations during the lockdown period, a significant difference on the number of observations in the pain/agitation range could be detected between the two groups ($p = 0.002$) (Table 2).

Also, nurses reported more episodes of agitation and excessive crying during the no_lockdown period compared to the lockdown period as well as a significantly reduced need for non-pharmacological and pharmacological interventions against pain/agitation during the lockdown period (Table 2). The same was true by excluding patients exposed to surgery. Also, in this case, NPASS values were significantly lower during the lockdown period (1.14 ± 1.6 vs 1.54 ± 2.0, $p = 0.000$), where episodes of pain/agitation were less documented (3.8% vs 8.1%, $p = 0.000$) as less needed was the need for pharmacological intervention (2.2% vs 3.4%, $p = 0.017$). The cumulative morphine exposure was 9.77 ± 5.45 mg/Kg/min in the no_lockdown period compared to 8.09 ± 5.38 mg/Kg/min of the lockdown period ($p = 0.002$). Concomitantly, the total kangaroo time



	Total number patient-day	Total number of hospitalized patients	Total number of preterm-days (<32GW)	Total number of hospitalized preterm (<32 GW)
LOCKDOWN	3044	146	2489	77
NO_LOCKDOWN	3170	176	2191	77

	Average days of hospitalization	
	All patients	Preterm (<32 GW)
LOCKDOWN	20.42	31.91
NO_LOCKDOWN	17.51	27.73

Fig. 1 Patient´s timeline. Total number of patients per day Hospitalzed at the NICU of the Medical University of Vienna between the 15 of March and the 1 June 2020, compared with an historical control (2019) of the timeline.

Table 1. Descriptive characteristics of study patients.

	Lockdown period $n = 77$	No_Lockdown period $n = 77$	*P*-value	Odd Ratio	Confidence Interval 95%	
					Lower margin	Upper margin
Sex female, *n* (%)	31 (%)	39 (%)	0.416	1.30	0.68	2.47
Gestational Week, mean ± SD	27.17 ± 2.77	27.17 ± 2.33	0.999		−0.81	0.81
Umbilical Ph, mean ± SD	7.29 ± 0.11	7.29 ± 0.14	0.848		−0.05	0.06
APGAR 5 min, mean ± SD	8.42 ± 0.98	8.30 ± 1.27	0.508		−0.24	0.48
Severe IVH, *n* (%)	6 (7.8%)	7 (9.0%)	0.772	1.18	0.37	3.70
PVL, *n* (%)	0 (0%)	1 (1.3%)	0.316	3.04	0.12	7.58
Seizures, *n* (%)	4 (5.2%)	3 (3.9%)	0.699	0.74	0.16	3.42
PDA, *n* (%)	41 (53%)	30 (39.0%)	0.075	0.56	0.29	1.06
ROP, *n* (%)	13 (16.8%)	19 (24.7%)	0.233	1.61	0.73	3.55
NEC, *n* (%)	5 (6.5%)	6 (7.8%)	0.754	1.22	0.35	4.17
Sepsis, *n* (%)	26 (33.8%)	45 (58.5%)	0.002	2.76	1.43	5.31
BPD, *n* (%)	10 (12.9%)	12 (15.58%)	0.645	1.24	0.50	3.06
PHVD Surgery, *n* (%)	4 (5.2%)	6 (7.8%)	0.513	1.54	0.41	5.70
PDA Surgery, *n* (%)	4 (5.2%)	6 (7.8%)	0.513	1.64	0.41	5.70
ROP Surgery, *n* (%)	0 (0%)	1 (1.3%)	0.316	3.04	0.12	7.58
NEC Surgery	2 (2.6%)	2 (2.6%)	0.999	1.00	0.13	7.29

IVH Intraventricular Hemorrhage, *PVL* Periventricular Leukomalacia, *ROP* Retinopathy of Prematurity, *NEC* Necrotizing Enterocolitis, *BPD* Bronchopulmonary Dysplasia.

remained unaffected in this subgroups analysis (161.76 ± 92.2 min. in lockdown vs 123.08 ± 64.11 min in no_lockdown).

In general, hospitalized infants underwent the same amount of clinical investigations ($p = 0.06$), had equal days of mechanical ventilation ($p = 0.09$), with the exception of days on high frequency ventilation ($p = 0.000$) (Table 3), which was higher in the lockdown period. The latter reflecting more likely a change in treatment strategy than an influence of lockdown on the clinical care of admitted infants. All previous mentioned results are summarized in the graphical abstract of the present manuscript.

Table 2. infants' wellbeing parameters during lockdown versus no_lockdown period.

	LOCKDOWN period	NO_LOCKDOWN period	*p*-value	Odd ratio	Confidence Interval 95%	
					Lower margin	Upper Margin
Total NPASS 0–10, mean ± SD	1.28 ± 1.7	1.78 ± 2.2	0.000		1.48	1.63
Total NPASS 5–10, mean ± SD	5.67 ± 0.8	5.96 ± 1.3	0.005		5.75	6.00
NPASS episodes with value ≥ 5, *n* (%)*	135 (5.40)	179 (8.17)	0.002	0.64	0.50	0.80
Nurses observation of excessive cry, *n* (%)	10 (0.40)	42 (1.92)	0.000	0.20	0.10	0.41
Nurses observation of agitation, *n* (%)	472 (18.90)	507 (23.4)	0.004	0.77	0.67	0.89
Nurses observation of increased reaction to pain, *n* (%)	23 (0.92)	41 (1.87)	0.005	0.48	0.29	0.81
Need of pharmacological intervention, *n* (%)	75 (3.00)	113 (5.16)	0.000	0.56	0.42	0.76
Cumulative days of exposure to analgesia/sedation, *n* (%)**	375 (15.01)	409 (18.67)	0.000	0.76	0.66	0.89
Cumulative morphine exposure (mg/Kg/min), mean ± SD	8 ± 5.05	10.42 ± 6.07	0.000		8.79	9.40
Use of sucrose, *n* (%)	342 (13.69)	359 (16.39)	0.009	0.80	0.68	0.95
Facilitated Tucking, *n* (%)	122 (4.88)	153 (6.98)	0.002	0.68	0.53	0.87
Swaddling, *n* (%)	323 (12.93)	313 (14.29)	0.176	0.89	0.75	1.05
Minutes on Kangaroo care, mean ± SD	163.36 ± 94.07	122.71 ± 64.03	0.000		34.15	47.14
Maternal Visits *n* (%)	1623 (64.97)	1332 (60.79)	0.003	1.19	1.34	1.06
Parental visits *n* (%)	186 (7.45)	990 (45.18)	0.000	0.09	0.08	0.11

Count data are normalized to the total number of hospitalized-patients-per-day ($n = 2498$ in Lockdown; $n = 2191$ in no_lockdown).
NPASS Neonatal Pain, Agitation and Sedation Scale.
*Maximum observed value-per-day.
**Patients received on a day at least one of the following medications: chloralhydrat, dexmedetomidin, diazepam, esketamin, metamizol, midazolam, morphin HCl, nalbuphin, paracetamol, phenobarbital, tramadol.

DISCUSSION

Contrary to the expectations and to what has been reported in the literature,[4,14] restricted visiting policies for parents during the first months of the SARS-CoV2 pandemic did not result in less visiting time and less time on Kangaroo care for patients in our institution. Although visiting episodes of both parents together were significantly reduced, the total daily visiting time of one parent as well as the total daily time on Kangaroo care were significantly higher in the lockdown period compared to the no_lockdown period. Moreover, infants were documented to be less stressed and in pain during the lockdown period, showing less need for both non-pharmacological and pharmacological intervention. These findings underline the importance of parental presence on neonatal wellbeing in a NICU setting.

It is well established that humans are social beings who need interpersonal relationships to maintain their psycho-physical health.[15–17] We usually search proximity especially in stressful situations, and we calm down once we receive adequate support.[16]

The attachment of a child to the caregiver is considered a biologically determined, instinctive behavior, linked above all to the emerging self-regulatory abilities.[16]

Hospitalization in a NICU implies per se an early separation between infant and mother, exposing the infant to a series of stressful and potentially adverse events, leaving parents in a state of prolonged concern and anxiety.[18] Potential risk factors for the emergence of a solid bonding, following the admission to a NICU, can therefore be found on both child's and parent's side, and may further be linked to the child's emotional and behavioral dysregulation.[19–23]

At the very beginning of the pandemic caused by a new type of Corona virus (SARS-CoV-2) there was very limited knowledge about horizontal and vertical transmission of the virus and its associated effects on newborns and premature babies. This resulted in difficulty of implementing uniform standards among NICUs worldwide.[24–26] Due to the knowledge about the beneficial effect of Kangaroo-mother-care,[5,7,8] it was a particular challenge for many hospitals to balance sufficient parental presence with the risk of infection and spreading of the virus.

The NIDCAP Federation International (NFI) recommended already at the beginning of the pandemic to adhere to policies supporting parental presence and active participation to infant care in the NICU. Also, the WHO recommended to only restrict, but not prohibit contact between parents and children in the hospital setting during the pandemic, ensuring parental involvement in the care of their sick newborns and premature infants.[10,11] Supporting results for these statements were provided also by Kostanzer and colleagues.[27] In a time of slightly reduced birth in Austria, where a reduced ratio of premature birth was consecutively documented,[28] restrictive visiting policies applied at the Department of Neonatology of the Medical University of Vienna were similar to those described by Yeo and colleagues,[29] summarizing 20 guidelines and recommendations on this topic from 17 countries by systematically searching the literature.[29]

A recent global survey regarding parents' experience in the NICU setting, reporting data from 2103 participants from 56 countries, underlines that 21% were not allowed to have skin-to-skin contact during the entire time of hospitalization, that only 30% were allowed to Kangaroo as often as desired, and that 21% were not even allowed to touch their baby in the incubator.[27]

In our department, parental visits were allowed and promoted throughout the whole course of the pandemic, although visits were restricted to only one parent per day at the beginning of the pandemic. Interestingly, the restriction to one parent at a time resulted in an increase of visiting hours per day in our NICUs. We have no explanation for this unexpected result, except the speculation that the possibilities arising from home-office and

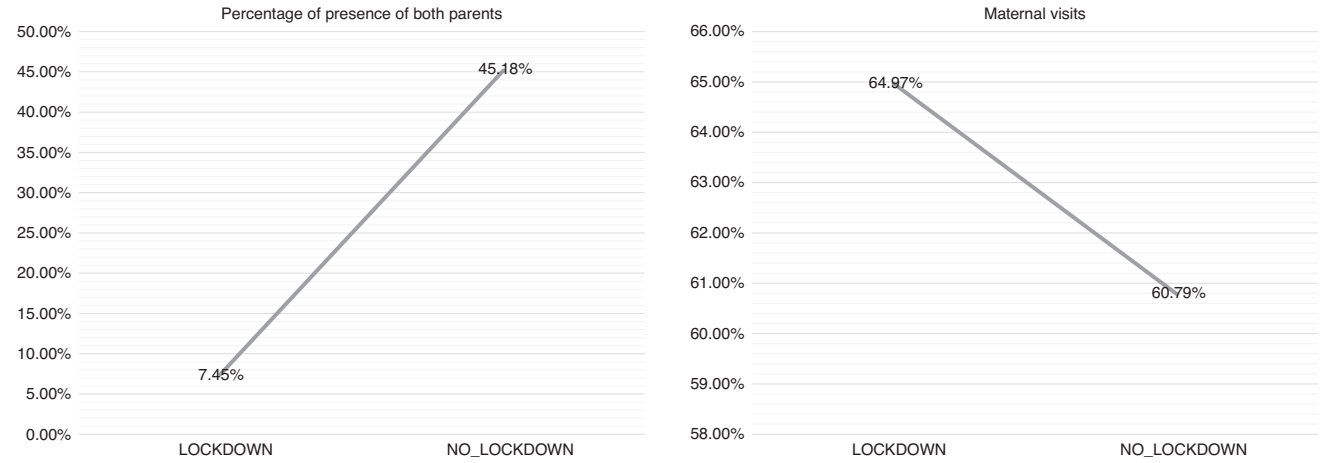


Fig. 2 Parental presence. Description of all documented visit episodes. Pointing out the decreased presence of both parents at the same time, but an increased maternal presence during the first Lockdown in Vienna.

Table 3. Procedures performed during the lockdown versus no_lockdown period.

	Lockdown	No_lockdown	*p* value	Odd ratio
Routine clinical procedures, *n* (%)*	665 (26.62)	637 (29.07)	0.06	0.88
Central line insertion, *n* (%)	3 (0.12)	2 (0.09)	0.76	1.31
Line insertion, any type, *n* (%)**	447 (17.89)	449 (20.49)	0.04	0.84
Days on mechanical ventilation, *n* (%)	216 (8.65)	160 (7.30)	0.09	1.20
Days on high frequency ventilation, *n* (%)	96 (3.84)	32 (1.46)	0.00	2.69

Data refer to normalized value, where *n* refers to the total number of events, while % to the frequency of the event corrected to the total number of patients per day in the time-line considered.
*Includes the following procedures: eye examination, echocardiography, hip-ultrasound, cranial ultrasound, abdominal ultrasound.
**Includes the following procedures: insertion of an arterial catheter, peripheral venous catheter, central venous catheter, peripherally inserted central catheter, Broviac catheter, arterial/venous umbilical catheter.

lockdown increased the flexibility of families regarding the organization of both work and family life.

The increase in visiting is also reflected in the significantly increased mean duration of kangaroo-care during the lockdown period; underlining and confirming the importance of parental presence for infant's wellbeing in a NICU setting and the recently published call for "zero separation" from Kostenzer and colleagues.[27]

Recent research shows that vertical and postnatal transmission as well as severity of illness of neonates with COVID-19 is rare.[30] In contrast, maternal deprivation and infants' isolation can have a strong impact on their wellbeing.[31] The risk of death of premature babies who are fully isolated in the NICU is 65 times greater than developing a fatal COVID-19 infection according to Minckas and colleagues.[32]

Moreover, handling and environmental design are two essential elements for the neuroprotective care of premature babies and sick newborns.[33] Another central finding of the current study is the fact that the generally limited number of visitors as well as reduced number of medical staff might have led to a more quiet environment, potentially also contributing to the positive impacts on patients' wellbeing observed.

Although there was no significant difference in the most important in-hospital morbidities, a statistically significant differences towards reduced sepsis rates could be observed. One might speculate that this could also be attributed to less crowding and fewer people in the wards during the lockdown period.

Limitation

This is a retrospective single center study aiming to investigate the general impact of restrictive visiting policies on parental presence in the NICU and the further impact on infants' wellbeing. Because of the descriptive nature of the study p-values should be interpreted with caution and do not allow any conclusion on causality. Moreover, impact of parental anxiety, stress bonding was not included in this study and deserves further investigation.

CONCLUSION

Restrictive visiting policies did not result in a reduction of visiting hours and hours on Kangaroo care in our NICUs during the first SARS-COV-2 related lockdown in Austria. On the contrary, average daily hours on Kangaroo care were increased during the lockdown period, as was infants' wellbeing documented by less pain and agitation. These findings confirm the importance of parental presence for infants' wellbeing in a NICU setting and support the recently published call for "zero separation" from Kostenzer and colleagues, even in a worldwide viral pandemic situation.

DATA AVAILABILITY

All data generated or analyzed during this study are included in this article [and/or] its supplementary material files. Further enquiries can be directed to the corresponding author.

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AUTHOR CONTRIBUTIONS

V.G., R.F., A.W., S.H., P.D., M.O., A.B., and K.K.-S. substantially contributed to the conceptualization of the study, study design and interpretation of the data, approving the final version of the manuscript. V.G., A.B., and K.K.-S. wrote the first draft of the manuscript, and critically reviewed data analysis. L.U. was involved in conceptualizing the manuscript, data extraction, performed statistics, critically reviewed the manuscript and approved its final version. A.F. provided data from the birth register in Austria, critically reviewed the manuscript and approved its final version. P.S. and J.B. were responsible for data acquisition, preparation of data and database, helped in writing the manuscript and approved its final version.

COMPETING INTERESTS

The authors declare no competing interests.

ETHICS APPROVAL

This is a retrospective data analysis conducted at the Medical University of Vienna after approval of the local ethics committee (ethic number: 1504/2020).

ADDITIONAL INFORMATION

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