Fig. S1. Diagram of morphometric landmarks and measurements used to characterize craniofacial growth, or lack thereof, in Bmp7^{ctrl} and Bmp7^{ncko} mice. (left panel): superior view of the skull. (right panel): mid-sagittal view of the skull.

Fig. S2. Respiratory pattern during normoxia in 2-week-old Bmp7^{ctrl} and Bmp7^{ncko} mice. (A) Respiratory frequency (fR). (B) Breath cycle duration (TTOT), Inspiratory time (Ti) and Expiratory time (Te). (C) Number of apneas/hour. (D) Number of sighs/hour. (E) Percentage (%) of post sigh apneas (PSA) / total number of sighs with < 2 PSA or ≥ 2 PSA apneas. There was no statistical difference between the groups (p > 0.05).
Fig. S3. Respiratory frequency (fR) during hypoxia and hyperoxia exposures. Absolute values from figure 5A shown as percentage (%) of baseline values during 5 and 15 min of hypoxia (10% O2) and 15 min of hyperoxia (40% O2), in Bmp7*crI, Bmp7*ncko (r) and Bmp7*ncko (a) mice.
Movie 1. Video representation of Bmp7\textsuperscript{ncko} mice experiencing apneas. Bmp7\textsuperscript{ncko} mice experience spontaneous apnea events. Mice were placed in plethysmography chambers and video of the mutant mouse behaviour during baseline measurements was recorded.

Movie 2. Video representation of Bmp7\textsuperscript{ncko} mice demonstrating lethargy. Bmp7\textsuperscript{ctrl} (top panel) and Bmp7\textsuperscript{ncko} (bottom panel) mice were placed on the treadmill for 5 mins after acclimatization to run. The Bmp7\textsuperscript{ctrl} mice demonstrated no signs of inactivity and rest, however the Bmp7\textsuperscript{ncko} mice demonstrate short period of running followed by long periods of rest.
Table S1. Two-tailed independent t-test statistical comparison of control and mutant morphometric data to accompany Figure 1. P14: 2-week-old mice; P21: 3-week-old mice; P30: 1-month-old mice. n=3 for each age group per genotype.

| Age | Degrees of freedom | T statistic | p-value |
|-----|------------------|------------|--------|
| **Facial length** | | | |
| P14 | 3 | 1.553238 | 0.218187 |
| **P21** | 4 | 12.44201 | 0.00024 |
| *P30* | 4 | 7.073297 | 0.002108 |
| **Snout angle** | | | |
| P14 | 2 | -0.51867 | 0.655675 |
| P21 | 2 | 1.393439 | 0.298145 |
| P30 | 4 | -1.83126 | 0.141021 |
| **Frontal bossing** | | | |
| P14 | 3 | -1.97315 | 0.143007 |
| P21 | 2 | -2.56254 | 0.12448 |
| P30 | 3 | 2.238238 | 0.111143 |
| **Nasal depression** | | | |
| P14 | 4 | 0.583792 | 0.590695 |
| P21 | 2 | 2.566908 | 0.124132 |
| P30 | 3 | -0.95634 | 0.409451 |
| **Nasal bone width** | | | |
| P14 | 2 | -2.77746 | 0.108867 |
| P21 | 4 | 0.518786 | 0.631289 |
| P30 | 2 | 0.243733 | 0.830158 |
| **Nasal bone length** | | | |
| P14 | 4 | 2.003438 | 0.115662 |
| P21 | 3 | 2.057673 | 0.13179 |
| P30 | 3 | -0.04358 | 0.96798 |
Table S2. Two-tailed independent t-test statistical results to accompany Figure 2 morphometric data from 1 month old mice. * indicates p<0.05; ** indicates p<0.001. n=3 for each age group per genotype.

| Measurement                                | Degrees of freedom | T statistic | p-value  |
|--------------------------------------------|--------------------|-------------|----------|
| cranial base angle 1                       | 19                 | 2.607641    | 0.017301 |
| cranial base angle 2                       | 23                 | 1.225689    | 0.232719 |
| basioccipital length                       | 25                 | 1.669665    | 0.107462 |
| basisphenoid length                        | 25                 | 5.914634    | 3.58E-06 |
| presphenoid length                         | 29                 | 0.313573    | 0.75609  |
| ethmoid length                             | 29                 | 0.311218    | 0.757861 |
| posterior cranial base length               | 25                 | 4.27551     | 0.000244 |
| facial length                              | 31                 | 6.013647    | 1.18E-06 |
| snout angle                                | 22                 | 5.541883    | 1.43E-05 |
| cranium maxilla angle                      | 23                 | 0.610879    | 0.54727  |
| frontal bossing                            | 25                 | -5.79575    | 4.84E-06 |
| nasal depression                           | 21                 | 7.335938    | 3.21E-07 |
| nasal bone width                           | 22                 | 1.879617    | 0.07347  |
| nasal bone length                          | 31                 | 3.12455     | 0.003847 |

Table S3. Bmp7<sup>ncko</sup> mice showed no changes to cranial base angles and lengths prior to nasal septum deviation. P14: 2-week-old-mice; P21: 3-week-old-mice; n=3 for each age group per genotype.

| Measurement                                | P14 Bmp7<sup>ctrl</sup> | P14 Bmp7<sup>ncko</sup> | p-value  | P21 Bmp7<sup>ctrl</sup> | P21 Bmp7<sup>ncko</sup> | p-value  |
|--------------------------------------------|--------------------------|--------------------------|----------|--------------------------|--------------------------|----------|
| cranial base angle 1                       | 154.93±1.42              | 151.66±5.99              | 0.40     | 150.55±2.71              | 144.46±6.62              | 0.13     |
| cranial base angle 2                       | 150.64±2.50              | 148.18±4.44              | 0.31     | 146.48±4.46              | 143.64±5.20              | 0.42     |
| basioccipital length                       | 2.89±0.33                | 2.758±0.15               | 0.44     | 3.32±0.71                | 2.93±0.29                | 0.29     |
| basisphenoid length                        | 2.712±0.20               | 2.468±0.19               | 0.086    | 2.67±0.31                | 2.69±0.37                | 0.92     |
| presphenoid length                         | 2.14±0.12                | 2.04±0.19                | 0.35     | 2.21±0.17                | 2.14±0.13                | 0.50     |
| ethmoid length                             | 4.36±0.28                | 4.5±0.37                 | 0.53     | 4.95±0.27                | 4.88±0.22                | 0.72     |
| posterior cranial base length               | 8.03±0.26                | 7.75±0.23                | 0.11     | 8.09±0.75                | 7.67±0.23                | 0.27     |
Table S4. Intraclass correlation (ICC) assessment to address intrarater reliability. Three P30 mice of each genotype were landmarked and measured in triplicate by a single rater.

| mouse ID | ICC   | confidence interval       |
|----------|-------|---------------------------|
|          |       | lower | upper               |
| C324     | 0.999524 | 0.998854 | 0.999833          |
| C325     | 0.999798 | 0.999513 | 0.999929          |
| C327     | 0.999274 | 0.998253 | 0.999746          |
| C531     | 0.996789 | 0.992222 | 0.998777          |
| C586     | 0.997853 | 0.994838 | 0.999247          |
| C600     | 0.998306 | 0.995721 | 0.999416          |
| K3308    | 0.998042 | 0.995252 | 0.999315          |
| K3309    | 0.998773 | 0.997022 | 0.999571          |

Table S5. The variability of tidal volume (V_T), breathing frequency (fR), breath duration (T_TOT) and inspiratory time (Ti) (mean ± S.D.) during normoxia in Bmp7ctrl, Bmp7ncko (r) and Bmp7ncko (a) mice. *P=0.016 for Bmp7ncko (r) versus Bmp7ncko (a) mice.

|                  | Bmp7ctrl (n=8) | Bmp7ncko (r) (n=5) | Bmp7ncko (a) (n=5) |
|------------------|----------------|--------------------|--------------------|
| _V_T_            |                |                    |                    |
| SD1              | 0.4±0.7        | 0                  | 0.6±0.8            |
| SD2              | 1.9±3.4        | 0                  | 2.7±3.9            |
| _fR_             |                |                    |                    |
| SD1              | 25.1±13.9      | 18.1±4.0           | 25.6±7.0           |
| SD2              | 50.2±17.1      | 34.5±6.1           | 50.0±9.0*          |
| _T_TOT_          |                |                    |                    |
| SD1              | 0.4±0.7        | 0                  | 0.6±0.8            |
| SD2              | 1.1±2.4        | 0.1                | 2.8±3.9            |
| _Ti_             |                |                    |                    |
| SD1              | 0.4±0.7        | 0                  | 0.6±0.8            |
| SD2              | 1.1±2.4        | 0                  | 2.7±3.9            |