**Supplementary Table 2. Macaque respondent agreement scores for validity and reliability by**

**discipline, 56 welfare indices (n=67 respondents).**

Potential indicators reaching less than 70% agreement for practicability have been shaded grey. Areas of focus are denoted by symbols as follows:

* **Animal-focused**:behavioural#, physiological/physical##
* **Environment-focused**:micro^ (i.e. cage), macro^^ (i.e. ambient)
* **Staff-focused**:procedural and development+, husbandry++

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| **Q3. Of the 56 indices, which do you think are the most valid and reliable for assessing NHP welfare? (count; percentage of n)** | | | | |
| **Neuroscience (n=34)** | **Toxicology (n=9)** | **Infectious disease (n=4)** | **Breeding (n=12)** | **Other (n=8)** |
| Self-harm behaviour# (29; 85.3%) | Huddled posture# (7; 77.8%) | Appetite# (4; 100%) | Social enrichment^ (12; 100%) | Body weight## (7; 87.5%) |
| Social enrichment^ (26; 76.5%) | Body weight## (7; 77.8%) | Stereotypy# (4; 100%) | Cage dimensions^ (12; 100%) | Health monitoring programme++ (7; 87.5%) |
| Appetite# (25; 73.5%) | Positive reinforcement training++ (7; 77.8%) | Self-harm behaviour# (4; 100%) | Self-harm behaviour# (10; 83.3%) | Staff training++ (7; 87.5%) |
| Body weight## (25; 73.5%) | Humane euthanasia programme++ (6; 66.7%) | Body weight## (4; 100%) | Social density^ (10; 83.3%) | Self-harm behaviour# (6; 75.0%) |
| Blood in faeces / urine## (25; 73.5%) | Stereotypy# (6; 66.7%) | Mortality## (4; 100%) | Vertical space^ (10; 83.3%) | Weaning age+ (6; 75.0%) |
| Cage dimensions^ (25; 73.5%) | Mortality## (6; 66.7%) | Cage dimensions^ (4; 100%) | Cage furniture^ (10; 83.3%) | Huddled posture# (5; 62.5)% |
| Stereotypy# (24; 70.6%) | NHP induced injuries## (6; 66.7%) | Vertical space^ (4; 100%) | Staff training++ (10; 83.3%) | Mortality## (5; 62.5)% |
| NHP induced injuries## (23; 67.6%) | Prolapse## (6; 66.7%) | Cage furniture^ (4; 100%) | Animal caregiver observations++ (10; 83.3%) | NHP induced injuries## (5; 62.5%) |
| Physical enrichment^ (23; 67.6%) | Vertical space^ (6; 66.7%) | See other NHPs^ (4; 100%) | Health monitoring programme++ (10; 83.3%) | Cage dimensions^ (5; 62.5%) |
| Health monitoring programme++ (23; 67.6%) | Staff training++ (6; 66.7%) | Social enrichment^ (4; 100%) | Behavioural management programme++ (10; 83.3%) | Social enrichment^ (5; 62.5%) |
| Behavioural management programme++ (23; 67.6%) | Cage dimensions^ (5; 55.5%) | Food enrichment^ (4; 100%) | Positive reinforcement training++ (10; 83.3%) | Behavioural management programme++ (5; 62.5%) |
| Positive reinforcement training++ (23; 67.6%) | See humans^ (5; 55.5%) | Physical enrichment^ (4; 100%) | Frequency of moves during lifetime+ (10; 83.3%) | Rearing history+ (5; 62.5%) |
| Food enrichment^ (22; 64.7%) | See other NHPs^ (5; 55.5%) | Environmental complexity^ (4; 100%) | Weaning age+ (10; 83.3%) | Appetite# (4; 50.0%) |
| See other NHPs^ (22; 64.7%) | Field of view^ (5; 55.5%) | Staff training++ (4; 100%) | Appetite# (9; 75.0%) | Dyspnoea# (4; 50.0%) |
| Discharges## (21; 61.8%) | Social enrichment^ (5; 55.5%) | Behavioural management programme++ (4; 100%) | Prolapse## (9: 75.0%) | Stereotypy# (4; 50.0%) |
| Cage furniture^ (21; 61.8%) | Social density^ (5; 55.5%) | Health monitoring programme++ (4; 100%) | NHP induced injuries## (9; 75.0%) | Fear of other NHPs# (4; 50.0%) |
| Vertical space^ (21; 61.8%) | Health monitoring programme++ (5; 55.5%) | Frequency of surgeries during lifetime+ (4; 100%) | Environmental complexity^  (9; 75.0%) | Blood in faeces / urine## (4; 50.0%) |
| Huddled posture# (20; 58.8%) | Self-harm behaviour# (5; 55.5%) | Frequency of medical procedures during lifetime+ (4; 100%) | Physical enrichment^ (9; 75.0%) | Environmental-induced injuries## (4; 50.0%) |
| Social density^ (20; 58.8%) | Environmental complexity^ (5; 55.5%) | Huddled posture# (3; 75.0%) | Humane euthanasia programme++ (8; 66.7%) | Social density^ (4; 50.0%) |
| Staff training++ (20; 58.8%) | Frequency of moves during lifetime+ (5; 55.5%) | Discharges## (3; 75.0%) | Huddled posture# (8; 66.7%) | See other NHPs^ (4; 50.0%) |
| Frequency of surgeries during lifetime+ (20; 58.8%) | Appetite# (5; 55.5%) | NHP induced injuries## (3; 75.0%) | Blood in faeces / urine## (8; 66.7%) | Vertical space^ (4; 50.0%) |
| Animal caregiver observations++ (19; 55.9%) | Food enrichment^ (5; 55.5%) | Social density^ (3; 75.0%) | Visual barriers between cages^ (8; 66.7%) | Environmental complexity^ (4; 50.0%) |
| Frequency of medical procedures during lifetime+ (19; 55.9%) | Rearing history+ (5; 55.5%) | Cage position^ (3; 75.0%) | Frequency of sedations during lifetime+ (8; 66.7%) | Cage furniture^ (4; 50.0%) |
| Mortality## (18; 52.9%) | Weaning age+ (5; 55.5%) | Field of view^ (3; 75.0%) | Rearing history+ (8; 66.7%) | Positive reinforcement training++ (4; 50.0%) |
| Prolapse## (18; 52.9%) | Blood in faeces / urine## (4; 44.4%) | Visual barriers within cages^ (3; 75.0%) | Mortality## (7; 58.3%) | Animal caregiver observations++ (4; 50.0%) |
| Frequency of sedations during lifetime+ (18; 52.9%) | Cage position^ (4; 44.4%) | Positive reinforcement training++ (3; 75.0%) | Food enrichment^ (7; 58.3%) | Humane euthanasia programme++ (4; 50.0%) |
| Environmental complexity^ (17; 50.0%) | Cage furniture^ (4; 44.4%) | Animal caregiver observations++ (3; 75.0%) | Provision of variety of food^ (7; 58.3% | Frequency chair restraint+ (4; 50.0%) |
| Visual barriers between cages^ (17; 50.0%) | Physical enrichment^ (4; 44.4%) | Humane euthanasia programme++ (3; 75.0%) | Visual barriers within cages^ (7; 58.3%) | Frequency of moves during lifetime+ (4; 50.0%) |
| Environmental-induced injuries## (16; 47.1%) | Destructible enrichment^ (4; 44.4%) | Destructible enrichment^ (3; 75.0%) | Body weight## (6; 50.0%) | Discharges## (3; 37.5%) |
| Weaning age+ (16; 47.1%) | Sensory enrichment^ (4; 44.4%) | Provision of variety of food^ (3; 75.0%) | Environmental-induced injuries## (6; 50.0%) | Prolapse## (3; 37.5%) |
| Dyspnoea# (15; 44.1%) | Provision of variety of food^ (;’ 44.4%) | Room temperature^^ (3; 75.0%) | Sensory enrichment^ (6; 50.0%) | Physical enrichment^ (3; 37.5%) |
| Visual barriers within cages^ (15; 44.1%) | Visual barriers between cages^ (4; 44.4%) | Frequency of sedations during lifetime+ (3; 75.0%) | See other NHPs^ (6; 50.0%) | Food enrichment^ (3; 37.5%) |
| Provision of variety of food^ (15; 44.1%) | Visual barriers within cages^ (4; 44.4%) | Weaning age+ (3; 75.0%) | Hear other NHPs^^ (6; 50.0%) | Visual barriers between cages^ (3; 37.5%) |
| Humane euthanasia programme++ (15; 44.1%) | Animal caregiver observations++ (4; 44.4%) | Dyspnoea# (2; 50.0%) | Room temperature^^ (6; 50.0%) | Visual barriers within cages^ (3; 37.5%) |
| Field of view^ (14; 41.2%) | Room cleaning frequency++ (4; 44.4%) | Blood in faeces / urine## (2; 50.0%) | Disease surveillance++ (6; 50.0%) | Room temperature^^ (3; 37.5%) |
| Frequency of moves during lifetime+ (13; 38.2%) | Behavioural management programme++ (4; 44.4.%) | Prolapse## (2; 50.0%) | Intentional exposure to novelty++ (6; 50.0%) | Humidity^^ (3; 37.5%) |
| Sensory enrichment^ (13; 38.2%) | Frequency of sedations during lifetime+ (4; 44.4%) | Environmental-induced injuries ## (2; 50.0%) | Room cleaning frequency++ (6; 50.0%) | Disease surveillance++ (3; 37.5%) |
| Room temperature^^ (13; 38.2%) | Frequency of surgeries during lifetime+ (4; 44.4%) | Manipulanda^ (2; 50.0%) | Daily number of meals++ (6; 50.0%) | Frequency of sedations during lifetime+ (3; 37.5%) |
| Fear of other NHPs# (12; 35.3%) | Frequency of medical procedures during lifetime+ (4; 44.4%) | Sensory enrichment^ (2; 50.0%) | Frequency of surgeries during lifetime+ (6; 50.0%) | Frequency of surgeries during lifetime+ (3; 37.5%) |
| Rearing history+ (12; 35.3%) | Fear of other NHPs# (3; 33.3%) | Visual barriers between cages^ (2; 50.0%) | Frequency of medical procedures during lifetime+ (6; 50.0%) | Frequency of medical procedures during lifetime+ (3; 37.5%) |
| Destructible enrichment^ (11; 32.4%) | Room temperature## (3; 33.3%) | Humidity^^ (2; 50.0%) | Fear of other NHPs# (5; 41.7%) | Cage position^ (2; 25.0%) |
| Hear other NHPs^^ (11; 32.4%) | Environmental-induced injuries## (3; 33.3%) | Light intensity^^ (2; 50.0%) | Stereotypy# (5; 41.7%) | Field of view^ (2; 25.0%) |
| Light intensity^^ (11; 32.4%) | Hear other NHPs^^ (3; 33.3%) | Disease surveillance++ (2; 50.0)% | Manipulanda^ (5; 41.7%) | Destructible enrichment^ (2; 25.0%) |
| Frequency chair restraint+ (11; 32.4%) | Disease surveillance++ (3; 33.3%) | Intentional exposure to novelty++ (2; 50%) | Room ventilation^^ (5; 41.7%) | Manipulanda^ (2; 25.0%) |
| Manipulanda^ (10; 29.4%) | Frequency of chair restraint+ (3; 33.3%) | Fear of other NHPs# (1; 25.0%) | Light intensity^^ (5; 41.7%) | Provision of browse^ (2; 25.0%) |
| Disease surveillance++ (10; 29.4%) | Intentional exposure to novelty++ (3; 33.3%) | See humans^ (1; 25.0%) | Humidity^^ (5; 41.7%) | Hear other NHPs^^ (2; 25.0%) |
| Cage position^ (9; 26.5%) | Manipulanda^ (2; 22.2%) | Provision of browse^ (1; 25.0%) | Daily timing of meals++ (5; 41.7%) | Room ventilation^^ (2; 25.0%) |
| Room cleaning frequency++ (9; 26.5%) | Humidity^^ (2; 22.2%) | Room ventilation^^ (1; 25.0%) | Frequency chair restraint+ (5; 41.7%) | Light intensity^^ (2; 25.0%) |
| Frequency of inoculations during lifetime+ (9; 26.5%) | Light intensity^^ (2; 22.2%) | Daily number of meals++ (1; 25.0%) | Discharges## (4; 33.3%) | Room cleaning frequency++ (2; 25.0%) |
| Room ventilation^^ (9; 26.5%) | Daily number of meals++ (2; 22,2%) | Daily timing of meals++ (1; 25.0%) | Dyspnoea## (4; 33.3%) | Daily number of meals++ (2; 25.0%) |
| Humidity^^ (8; 23.5%) | Daily timing of meals++ (2; 22.2%) | Frequency of moves during lifetime++ (1; 25.0%) | Cage position^ (4; 33.3%) | Sensory enrichment^ (1; 12.5%) |
| See humans^ (8; 23.5%) | Discharges## (1; 11.1%) | Room cleaning frequency++ (1; 25.0%) | Field of view^ (4; 33.3%) | Provision of variety of food^ (1; 12.5%) |
| Intentional exposure to novelty++ (7; 20.6%) | Dyspnoea## (1; 11.1%) | Rearing history+ (1; 25.0%) | Destructible enrichment^ (4; 33.3%) | See humans^ (1; 12.5%) |
| Daily number of meals++ (7; 20.6%) | Provision of browse^ (1; 11.1%) | Hear other NHPs^^ (0; 0.0%) | Provision of browse^ (3; 25.0%) | Intentional exposure to novelty++ (0; 0.0%) |
| Daily timing of meals++ (7; 20.6%) | Room ventilation^^ (1; 11.1%) | Frequency of inoculations during lifetime+ (0; 0.0%) | See humans^ (2; 16.7%) | Daily timing of meals++ (0; 0.0%) |
| Provision of browse^ (5; 14.7%) | Frequency of inoculations during lifetime+ (1; 11.1%) | Frequency of chair restraint+ (0; 0.0%) | Frequency of inoculations during lifetime+ (2; 16.7%) | Frequency of inoculations during lifetime+ (0; 0.0%) |
| **Additional measures that are valid, reliable, and practical for assessing welfare:** | | | | |
| Activity level, including presence of depressive-like behaviour or non-alert inactive behaviour (4); Willingness to cooperate with procedures/experimental tasks (2); Performance in the task (1); Natural positive behaviour, such as play and allogrooming (2); Water intake (1); Body posture (1); Aggression (1); Vocalisations (1) | Willingness to cooperate with procedures (1) |  | Inactive but not alert behaviour (1); Over-grooming (1); Alopecia (1) | Sleep monitoring (1); Play behaviour (1) |