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| **Should initial suctioning of the nose and mouth vs. no initial suctioning be used for neonates who are born through non-meconium-stained amniotic fluid?** | |
| **Population:** | neonates who are born through non-meconium-stained amniotic fluid |
| **Intervention:** | initial suctioning of the nose and mouth |
| **Comparison:** | no initial suctioning |
| **Main outcomes:** | Receipt of assisted ventilation; Advanced resuscitation and stabilization interventions (intubation, chest compressions, epinephrine (adrenaline) in the Delivery Room (DR); Saturations at 5 minutes; Saturations at 9 minutes; Saturations at 10 minutes; Time to 86% saturation; Adverse effects of intervention - time to 92% saturations; Unanticipated admission to the NICU; Heart rate at 5 minutes; Apgar Score of 10 at 5 minutes; Subgroup analysis saturations at 5 minutes - vaginal births; Subgroup analysis saturations at 5 minutes - c/s; Respiratory Rate (any RR>60 in first 24 hours of life); |
| **Setting:** | Any |
| **Perspective:** | Population |
| **Background:** | This question has not been addressed in a systematic review nor subjected to a GRADE analysis of certainty of evidence by ILCOR previously. A Scoping Review (NLS 596) conducted in 2019 found sufficient evidence to justify conducting a systematic review. {Wyckoff 2020 S185} |
| **Conflict of interests:** | * Author Ersdal has published observational studies on use of resuscitation maneuvers including suctioning in low resource settings and was excluded from decisions about inclusion or bias assessment for these studies {Ersdal 2012 869, Ersdal 2018 171, Haug 2020 68, Størdal 2020 e0240520, Mduma 2019 e030572, Msemo 2013 353}. * Author Rüdiger has published an observational study about suctioning immediately after birth {Konstantelos 2015 777} and was excluded from decisions about inclusion or bias assessment for this study. |

# Assessment

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| Problem Is the problem a priority? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ○ Probably yes ● Yes ○ Varies ○ Don't know | Suctioning of clear amniotic fluid is a very important topic worldwide as it affects many newly born infants including those not requiring/receiving resuscitation. It is very important to know if there is any evidence of benefit or harm as this has traditionally been a part of worldwide neonatal care which has not been assessed.  Transition from fetus to newborn involves the infant clearing lung fluid and expanding their lungs with air. Longstanding historical practice has been to use oro/nasopharyngeal suctioning at birth routinely to remove fluids. There have been increasing concerns that this practice may not confer benefit and may have undesirable consequences.  This has led ILCOR to recommend that ***“Suctioning immediately after birth, whether with a bulb syringe or suction catheter, may be considered only if the airway appears obstructed or if PPV is required”***. {Wyckoff 2015 543 }  The World Health Organisation (WHO) reviewed 3 studies included in this systematic review {Gungor 2006 9, Gungor 2005 453, Waltman 2004 32} which examined the effect of oral and nasal suctioning at birth on oxygen saturation (SpO2) levels at 5 minutes of life. They graded the quality of evidence for this outcome as high. The pooled mean difference (MD) in oxygen saturation levels was 9.8% lower (95% CI -10.2% to -9.4%) in those who underwent oropharyngeal or nasopharyngeal suctioning. There was a significant reduction in the proportion of infants with normal Apgar scores in the suctioning group compared to the group with no suctioning (RR 0.54, 95% CI 0.29 to 1.00, p=0.049). {WHO 2012}  The WHO said ***“In neonates born through clear amniotic fluid who start breathing on their own after birth, suctioning of the mouth and nose should not be performed.”*** (strong recommendation, high quality of evidence) they also say ***“In neonates born through clear amniotic fluid who do not start breathing after thorough drying and rubbing the back 2-3 times, suctioning of the mouth and nose should not be done routinely before initiating positive pressure ventilation. Suctioning should be done only if the mouth or nose is full of secretions.”*** (strong recommendation, GDG consensus in absence of published evidence). (WHO strong recommendation, based on high quality evidence of lower oxygen saturation and low quality evidence of lower Apgar scores). {WHO 2012}  An ILCOR scoping review **Suctioning clear amniotic fluid during resuscitation in the delivery room (#NLS596)** found sufficient evidence to justify a systematic review of suctioning clear amniotic review at delivery. {Wyckoff 2020 S185}  This systematic review found 9 RCTs and 2 prospective observational studies all of whom note that suctioning of clear amniotic fluid from the mouth and / or nose has been a common or routine historical practice. A prospective observational study {Konstantelos 2015 777} showed that resuscitation guidelines are often not followed and oral, nasal or oronasopharyngeal suctioning is carried out outside of current resuscitation guidelines. It also showed that suctioning can take a long time which raises the potential for a delay in other resuscitation measures if these were required. | This question was prioritized by ILCOR because although it is a widespread practice, it has not been addressed in a systematic review nor subjected to a GRADE analysis of certainty of evidence by ILCOR previously. A Scoping Review (NLS 596) conducted in 2019 and found sufficient evidence to justify a systematic review. {Wyckoff 2020 S185} Because a systematic review had not yet been performed, the treatment recommendation in 2020 was that “*This treatment recommendation is unchanged from 2010. Routine intrapartum oropharyngeal and nasopharyngeal suctioning for newborn infants with clear or meconium-stained amniotic fluid is no longer recommended*”. {Perlman 2010 S516, Wyckoff 2020 S185}  The ILCOR scoping review (#NLS596) found that nasopharyngeal suctioning may have serious risks and has been associated with irritation to mucous membranes and increased risk for iatrogenic infection {Gungor 2006 9, Gungor 2005 453}, bradycardia {Cordero 1971 441, Gungor 2006 9}, apnea {Cordero 1971 441}, hypoxemia and arterial oxygen desaturation {Carrasco 1997 832, Gungor 2005 453, Kohlhauser 2000 270}, hypercapnea {Skov 1992 389}, impaired cerebral blood flow regulation {Perlman 1983 329} and increased intracranial pressure {Fisher 1982 416 }. Fluctuations in cerebral blood flow have been shown to cause intraventricular haemorrhage in premature infants and neonatal animals. It is possible that nasopharyngeal suction produces vagal-induced bradycardia and increased risk of infection. {McCartney 2000 217}  The procedure may take a long time {Konstantelos 2015 777}, and newborns who received suctioning compared with the control group had significantly lower oxygen saturation levels through the first 6 minutes of life and took longer to reach a normal range {Carrasco 1997 832, Gungor 2006 9, Gungor 2005 453, Konstantelos 2015 777}. Suctioning was commonly applied outside of resuscitation guidelines. {Konstantelos 2015 777} |
| Desirable Effects How substantial are the desirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Trivial ○ Small ○ Moderate ○ Large ○ Varies ○ Don't know | For **unanticipated admission to the NICU** one RCT included 448 infants of ≥35 weeks’ gestation, **clinical benefit or harm cannot be excluded** (Relative risk [RR], 1.50; 95% CI, 0.96, 2.30 p=0.07) absolute risk increase 91 more per 1000 with no suctioning vs. suctioning (95% CI, 8 fewer per 1000 to 238 more patients per 1000 patient receiving no suctioning). Evidence was of very low certainty (downgraded for serious risk of bias and indirectness and very serious imprecision) {Kelleher 2013 326}.  For the outcomes of receipt of assisted ventilation, need for advanced resuscitation, no studies reporting analysable data were found. | The ILCOR NLS Task Force were concerned that data about NICU admissions in the Kelleher study was either an underpowered secondary outcome or a type 1 error. There was not a pathophysiological explanation for this finding given the other saturation and heart rate data. The authors of the Kelleher study advised caution in interpreting this outcome. {Kelleher 2013 326}  One observational (case control) study reported that immediate postnatal oronasopharyngeal suctioning did not compromise cerebral and muscle tissue oxygenation. {Pocivalnik 2015 153} |
| Undesirable Effects How substantial are the undesirable anticipated effects? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large ● Moderate ○ Small ○ Trivial ○ Varies ○ Don't know | This systematic review found 9 randomized controlled trials and 2 observational studies comparing suctioning vs no suctioning.  Two RCTs {Gungor 2005 453, Gungor 2006 9} have very similar results and very low standard deviations around their oxygen saturation measurements. Clarification about the data has been sought and where relevant outcome data with and without these 2 RCTS are presented.  **Outcomes related to oxygen saturations:**  For the important secondary outcome of of **oxygen saturations at 5 minutes**5 RCTs including 560 participants found for suctioning vs. no suctioning **possible harm** (mean difference (MD] -9.08% (95%CI -9.51 to -8.66% p<0.001)). Evidence was of **very low certainty** (downgraded for serious risk of bias, serious inconsistency, very serious indirectness). {Bancalari 2019 271, Gungor 2005 453, Gungor 2006 9, Modarres Nejad 2014 400, Takahashi 2009 261}.  Analysis without the two Gungor studies found for suctioning vs no suctioning, **clinical benefit or harm could not be excluded** (MD -0.26% (95%CI -1.77 to 1.26%) p=0.74). The evidence was of very low certainty, (downgraded for serious risk of bias, serious inconsistency and very serious indirectness). {Bancalari 2019 271, Modarres Nejad 2014 400, Takahashi 2009 261}  For the important secondary outcome of of **oxygen saturations at 9 minutes** 3 RCTs including 280 participants, for suctioning vs no suctioning found **possible harm** (MD -1.52% 95% CI -2.69 to -0.35% p=0.01). This finding was statistically significant but of unclear clinical significance. Evidence was of **very low certainty** (downgraded for serious risk of bias, serious inconsistency, very serious indirectness) {Bancalari 2019 271, Modarres Nejad 2014 400, Takahashi 2009 261}  For the important secondary outcome of of **oxygen saturations at 10 minutes** 2 RCTs including 110 participants found **clinical benefit or harm could not be excluded** with no significant difference in saturations in infants receiving suction (MD -0.14 (95%CI -1.17, 0.89) p=0.78]. Evidence was of **very low certainty** (downgraded for serious risk of bias, serious inconsistency, very serious indirectness) {Bancalari 2019 271, Takahashi 2009 261}.  For the important secondary outcome of **oxygen saturations over the first 10 minutes of life** the data were presented in different ways in different studies, precluding a comprehensive meta-analysis of all studies that reported data on this outcome.  For the important secondary outcome of of **oxygen saturations over the first 10 minutes from birth** 3 RCTs {Bancalari 2019 271, Carrasco 1997 832, Gungor 2006 9} including 254 participants provided evidence of **very low certainty** (downgraded for serious risk of bias, serious imprecision and very serious indirectness) and 1 prospective observational study {Konstantelos 2015} including 346 participants gave graphical representations of saturations over time from birth. All show a trend to slightly lower oxygen saturations (suctioning vs. no suctioning) although by 10 minutes of age saturations were very similar in infants who did and did not receive suctioning at birth.  One RCT including 20 healthy term participants reported slightly lower saturations in those receiving suctioning at 5 minutes but a trend to slightly higher saturation readings at 10 and 15 minutes. Evidence was of **very low certainty** (downgraded for very serious risk of bias, very serious indirectness and very serious imprecision). {Waltman 2004, 32}  **For the important secondary outcome of time to reach target oxygen saturations of 86% or 92%**  Some studies {Gungor 2005 453, Gungor 2006 9, Modarres Nejad 2014 400} reported the proportion of infants that received suctioning or no suctioning who achieved target saturations at certain time points whilst another {Carrasco 1997 832} reported mean (SD) time to achieve target saturations. The target saturations reported are those selected by studies included in this systematic review.  Two RCTs {Modarres Nejad 2014 400, Carrasco 1997 832} provided data in a form that could not be meta-analysed. In one RCT including 170 participants all infants with suctioning achieved 92% saturations by 11 minutes vs. 9 minutes in the group receiving no suction. {Modarres Nejad 2014 400} The authors noted that no babies in the suctioned group achieved 92% saturations before 8 minutes. In one RCT including 30 participants, mean (SD) time to achieve saturations of 86% was 8.2 +/-3.3 minutes (suctioning) and 5.0 minutes +/- 1.2 (no suction). For 92% saturations the times (suctioning vs. no suctioning) were 10.2 +/-3.3 minutes and 6.8 +/- 1.8 minutes respectively. {Carrasco 1997 832}  Two RCTs {Gungor 2005 453, Gungor 2006 9} including 280 participants (all healthy, term infants) found 140 infants with no suctioning all achieved oxygen saturations of 86% by 5 minutes and 92% by 6 minutes. In contrast only 2.9% of the 140 infants with suctioning achieved saturations of 86% by 5 minutes and none achieved saturations of 92% by 6 minutes. In the suctioning group the maximum time to achieve saturations of 86% and 92% were 8 and 11 minutes, respectively. Evidence was of **very low certainty** (downgraded for serious imprecision and very serious indirectness).  One prospective observational study {Konstantelos 2015 777} including 346 participants reported 1 episode of severe desaturation to <75% following suctioning.  **Outcomes relating to Apgar scores**  Insufficient data on the important secondary outcome of low Apgar scores (<7) was available for analysis.  For the secondary outcome of **Apgar scores** (score of 10 at 5 minutes) 3 RCTs including 450 participants showed **possible harm** (Relative risk [RR], 0.63; 95% CI 0.57, 0.70 p<0.001) ARD (suctioning vs. no suctioning) 370 fewer (95% CI 430 fewer to 300 fewer per 1000 patients) with suctioning). This finding was statistically significant but of unclear clinical significance. Evidence was of **very low certainty** (downgraded for serious indirectness) {Gungor 2005 453, Gungor 2006 9, Modarres Nejad 2014 400}.  Analysis without the two Gungor studies showed no significant difference in Apgar scores (score of 10 at 5 minutes) [MD 1.00 (0.98, 1.02) p=1] so in this analysis **clinical benefit or harm could not be excluded**.  **Other outcomes**  One study reported that suctioning took between 2 and 154 seconds. {Konstantelos 2015 777} In this study, suctioning was performed a median of 2.5 time per infant with the median time for each suctioning episode being 9 seconds, which has potential to delay other resuscitation measures if these are required. | Some case series (ineligible for the review) described serious consequences (including bradycardia and apnoea and in one case post suctioning cardiac arrest. {Cordero 1971 441}  Repeated use of suction devices may have potential infection risks, if methods for ensuring sterility are insufficient. This could apply in some settings with low or very low healthcare resources.  The NLS task force discussed whether the oxygen saturation data should be analysed using a random or fixed effects model. The more commonly used fixed effects model gave greater weight to studies with smaller standard deviations including the two Gungor studies which are surprisingly similar in their results. A random effects model gave more even weighting across studies however, this was felt to be methodologically inappropriate as other unaccounted for random effects were not present. Consequently, a fixed effects model was used.  The studies that reported oxygen saturations at set time points all showed either no difference or lower saturations in infants receiving suctioning vs. no suction. The pooled mean difference narrows over the first few minutes of life with little difference from 10 minutes of age onwards. This pattern was the same whether a fixed or random effects model was used.  Three RCTs {Bancalari 2019 271, Carrasco 1997 832, Gungor 2006 9} and 1 prospective observational study {Konstantelos 2015 777} gave graphical representations of saturations over time from birth. All show slightly higher oxygen saturations over the first 5-10 minutes of life in babies who had no suctioning. One RCT including 20 healthy term participants reported slightly lower saturations in those receiving suctioning at 5 minutes but slightly higher saturation readings at 10 and 15 minutes Evidence was of **very low certainty** (downgraded for very serious risk of bias, very serious indirectness and very serious imprecision). {Waltman 2004, 32} |
| Certainty of evidence What is the overall certainty of the evidence of effects? | | |
| Judgement | Research evidence | Additional considerations |
| ● Very low ○ Low ○ Moderate ○ High ○ No included studies | For the important outcome of **assisted ventilation,** the **certainty of evidence was very low** downgraded for very serious risk of bias, serious inconsistency, very serious indirectness and very serious imprecision.  For the critical outcome of **advanced resuscitation,** the **certainty of evidence was very low** downgraded for very serious risk of bias, serious inconsistency, very serious indirectness and very serious imprecision.  Data was available for the important outcome of **adverse effects of intervention**.   * Evidence on **oxygen saturation at 5 minutes** was of **very low certainty** * Evidence on time to reach **oxygen saturations of 86%** was of **very low certainty** * Evidence on time to reach **oxygen saturations of 92%** was of **very low certainty** * Evidence on **heart rate at 5 minutes** was of **very low certainty**   Insufficient data were available to be able to report on the important outcome of **receipt or duration of supplemental oxygen**.  Insufficient data was available to be able to report on the important outcome of **soft tissue injury or infection or bradycardia.** | The results of 2 RCTs {Gungor 2005 453, Gungor 2006 9}, (one including infants born by caesarean section and the other vaginal births) for oxygen saturation and heart rate levels are almost identical and have much smaller standard deviations than other studies. The task force has sought clarification from the authors about the data. Outcome data with and without these 2 RCTS are presented. |
| Values Is there important uncertainty about or variability in how much people value the main outcomes? | | |
| Judgement | Research evidence | Additional considerations |
| ● Important uncertainty or variability ○ Possibly important uncertainty or variability ○ Probably no important uncertainty or variability ○ No important uncertainty or variability | The extent to which parents and clinicians value the outcomes selected for this review have not been assessed comprehensively or with any rigor. However, the outcomes were selected by consensus of the NLS Task Force as important. Although most outcomes represent only transient benefit or harm, they were considered significant because of the implications for nearly every birth worldwide. |  |
| Balance of effects Does the balance between desirable and undesirable effects favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ● Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know | Intervention is receiving suctioning and the comparison is no suctioning.  There was little evidence of desirable effects and some evidence of undesirable effects including:   * Lower oxygen saturations at 5 minutes of age in infants who had received initial suction of the mouth or nose although this finding is not present in the analysis without the Gungor studies. * The increased time to reach saturations of 86% and 92% * Potential for harm (soft tissue injury and case reports of severe bradycardia) * Fewer infants who had received suctioning compared with no suctioning achieved an Apgar score of 10 at 5 minutes although this finding is not present in the analysis without the Gungor studies. * Potential delay in initiating resuscitation measures if these were needed, however the group noted that the babies in this systematic review were predominantly healthy term babies * Concerns over carrying out an invasive procedure if there is no evidence of benefit   Overall, undesirable effects reported in studies outweighed desirable effects. | The Task Force considered that for a very small proportion of infants, there is unsuspected obstruction of the airway (e.g., by mucous or vernix) even in the presence of clear amniotic fluid. |
| Resources required How large are the resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ○ Varies ● Don't know | No studies were identified that addressed resource utilization. Suction devices are commonly available in delivery settings and would need to remain in order to manage the rare situations where the airway is obstructed by particulate matter. If suctioning of clear amniotic fluid was not required then a reduction in suctioning consumable equipment (e.g. suction catheters) might be achieved. |  |
| Certainty of evidence of required resources What is the certainty of the evidence of resource requirements (costs)? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Very low ○ Low ○ Moderate ○ High ● No included studies | There were no studies that reported the impact of suctioning clear amniotic fluid vs. not suctioning on resources. As the comparison is removal of an intervention it is unlikely that additional staffing or equipment costs would be incurred. However, there may be costs involved in training and practice change strategies. |  |
| Cost effectiveness Does the cost-effectiveness of the intervention favor the intervention or the comparison? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ○ Probably favors the intervention ○ Favors the intervention ○ Varies ● No included studies | No studies were found that compared the cost-effectiveness of suctioning clear amniotic fluid vs. not suctioning clear amniotic fluid in the delivery room. | Reduction in the use of suctioning may reduce consumable costs. That reduction in cost may be of much greater importance in low resource settings. |
| Equity What would be the impact on health equity? | | |
| Judgement | Research evidence | Additional considerations |
| ○ Reduced ○ Probably reduced ○ Probably no impact ○ Probably increased ○ Increased ○ Varies ● Don't know | No studies were found that considered the equity of recommendations on suctioning clear amniotic fluid vs. no suctioning of clear amniotic fluid in the delivery room. | We speculate that not suctioning clear amniotic fluid is an option in all settings and may increase health equity globally. However, training to update practice may vary in availability especially in low resource settings. |
| Acceptability Is the intervention acceptable to key stakeholders? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | Suctioning of clear amniotic fluid is widely practiced. ILCOR and WHO recommendations have advised against routine suction of clear amniotic fluid.  The influence of longstanding historical practice and the perceived need to actively manage newborn babies drives persistence in suctioning of clear fluid.  A prospective observational study that adherence to a resuscitation guideline that recommended no suctioning showed poor adherence, with 66% of preterm infants and 23% of term infants born through clear amniotic liquid still receiving suctioning. {Konstantelos 2015 777}  In contrast, an Australian population-based study reported declining rates of suctioning over a 10-year period from approximately 25% to 10% of all liveborn infants, which was presumed to be in response to changes in guidelines. {Kapadia 2020 126 } | Suctioning of clear amniotic fluid is a long standing, well established clinical practice. This weight of historical practice is evident in the persistence of suctioning practices despite increasingly stated recommendations against this.  There may be a perception that suction provides a stimulus to breathe. In settings with a lack of training this provides a strong incentive to suction in the hope that further intervention will not be necessary. An emphasis on mechanical suction in historic guidelines may have contributed to this {WHO 1998}.  All of the papers in this review commented on suctioning of clear amniotic fluid remaining a common practice. |
| Feasibility Is the intervention feasible to implement? | | |
| Judgement | Research evidence | Additional considerations |
| ○ No ○ Probably no ● Probably yes ○ Yes ○ Varies ○ Don't know | Removing a currently practiced intervention should be feasible from a resource perspective. Teaching to update practice to current recommendations will be more feasible in some health settings than others. Longstanding historical practice may influence the human factors aspect of feasibility. |  |

# Summary of judgements

|  | **Judgement** | | | | | | |
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| **Problem** | No | Probably no | Probably yes | **Yes** |  | Varies | Don't know |
| **Desirable Effects** | **Trivial** | Small | Moderate | Large |  | Varies | Don't know |
| **Undesirable Effects** | Large | **Moderate** | Small | Trivial |  | Varies | Don't know |
| **Certainty of evidence** | **Very low** | Low | Moderate | High |  |  | No included studies |
| **Values** | **Important uncertainty or variability** | Possibly important uncertainty or variability | Probably no important uncertainty or variability | No important uncertainty or variability |  |  |  |
| **Balance of effects** | **Favors the comparison** | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | Varies | Don't know |
| **Resources required** | Large costs | Moderate costs | Negligible costs and savings | Moderate savings | Large savings | Varies | **Don't know** |
| **Certainty of evidence of required resources** | Very low | Low | Moderate | High |  |  | **No included studies** |
| **Cost effectiveness** | Favors the comparison | Probably favors the comparison | Does not favor either the intervention or the comparison | Probably favors the intervention | Favors the intervention | Varies | **No included studies** |
| **Equity** | Reduced | Probably reduced | Probably no impact | Probably increased | Increased | Varies | **Don't know** |
| **Acceptability** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |
| **Feasibility** | No | Probably no | **Probably yes** | Yes |  | Varies | Don't know |

# Type of recommendation

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| Strong recommendation against the intervention | **Conditional recommendation against the intervention** | Conditional recommendation for either the intervention or the comparison | Conditional recommendation for the intervention | Strong recommendation for the intervention |
| ○ | **●** | ○ | ○ | ○ |

# Conclusions

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| Recommendation |
| We suggest that suctioning of clear amniotic fluid from the nose and mouth should not be used as a routine step for newborn infants at birth (weak recommendation, very low certainty of evidence). Airway positioning and suctioning should be considered if airway obstruction is suspected (good practice statement). |

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| Justification |
| **Overall justification**  In making this recommendation, the Newborn Life Support Task Force noted that studies that reported oxygen saturations at set time points up to 10 minutes all showed either no difference or lower saturations in babies receiving suctioning vs. no suctioning. The pooled mean difference in oxygen saturations (MD -9.08% (95%CI -9.51, -8.66) p<0.001) at 5 minutes narrowed over the first 10 minutes of life with little difference from 10 minutes of age onwards. Studies that reported saturations at fixed time points and studies that displayed saturation data as a graph all showed a pattern of lower saturations over the first few minutes of life in infants receiving suctioning. This was supported by studies that looked the time taken to achieve target saturations, these found that infants that received suctioning at birth took longer to achieve those target saturations.  The Task Force concluded that no benefit from routine suctioning of clear amniotic fluid was found. They were hesitant to conclude possible harm from lower saturations in the first 10 minutes of life because the data consisted of graphical trends, although it was noted that this was a consistent trend to lower oxygen saturation in those with suctioning. The statistically significant reduction in oxygen saturations at 5 minutes was not seen in all analyses and the statistically significant reduction in oxygen saturations at 9 minutes may not be clinically significant.  The Task Force considered that it was not justified to routinely use an intervention such as oral and nasal suctioning in the absence of benefit. Although the participants included in studies included in this systematic review were predominantly healthy term newborn infants, the potential for delay in resuscitation for those who required it was also a concern.  It was also noted that fewer babies receiving suctioning achieved a 5 minute Apgar score of 10 (RR 0.63; 95% CI, 0.57 to 0.70 p<0.001; ARD 370 fewer per 1000 95% CI 430 fewer to 300 fewer per 1000).  Subgroup analysis suggested an interaction by delivery type (vaginal delivery vs. caesarean section) and found high heterogeneity. The interaction and the heterogeneity were not evident when the Gungor studies were removed, an analysis that was conducted to explore the high heterogeneity.  This systematic review recommendation does not apply to situations where there are concerns regarding airway obstruction.  **Detailed justification**  *Balance of effects*  Undesirable effects of suctioning clear amniotic fluid outweighed the desirable effects |

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| Subgroup considerations |
| The following subgroup analyses were predefined in the protocol.  Gestational age categories (gestational age is used define categories and birthweight is only used in studies that only used birthweight)   * ≥34 +0 weeks or >2000g * 28 +0 - 33 +6 weeks or 1000-2000g * <28 +0 weeks or <1000g   Route and method of delivery (Vaginal vs Caesarean section)  Suction device used (Bulb vs Catheter Suction)  **Gestational age**  Insufficient data were available for this subgroup analysis as the studies included in this systematic review were predominantly in term babies. Only one prospective observational study {Konstantelos 2015 777} and one RCT {Kelleher 2013 326} included both preterm and term infants.  The Kelleher study included infants ≥35 weeks although the median (IQR) gestation was 39 (38–40) weeks for the no suction (wipe) group and 39 (38–40) for suction group. {Kelleher 2013 326} The majority of the infants in the Konstantelos study were born at term. {Konstantelos 2015 777}  **Vaginal vs Caesarean section**  Insufficient data were available for a subgroup analysis of the following outcomes: receipt of assisted ventilation, advanced resuscitation, receipt of supplemental oxygen, unanticipated NICU admission.  For the outcome of oxygen saturations at 5 minutes there is a difference favoring no suction in both vaginal delivery and caesarean section subgroups with high heterogeneity within subgroups (I2 =97%) and evidence of an interaction by delivery type (test for subgroup differences 0.03) also with high heterogeneity between subgroups (I2=78.6%). Given the very high heterogeneity, despite almost identical results in two studies {Gungor 2005 453, Gungor 2006 9}, a sensitivity analysis was carried out. With the two Gungor studies removed from both subgroups there was no difference in saturations in either subgroup with no interaction (p=0.86) and heterogeneity reduced (I2=0%).  Among the two methodologically identical RCTs, {Gungor 2005 453, Gungor 2006 9} one studied vaginally born infants and the other those born by caesarean section, each included 140 participants and found identical time to achieve saturations of 86% or 92%.  **Suction device used (Bulb vs Catheter Suction)**  Two RCTs {Kelleher 2013 326, Waltman 2004 32} studied infants receiving bulb suction vs. no suction or wiping. No studies compared bulb suction to catheter suction. Outcomes in the Kelleher and Waltman studies were reported differently, hence comparison could not be made and subgroup analysis was not possible. |

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| Implementation considerations |
| One study {Konstantelos 2015 777} showed poor adherence to guidelines whilst another {Kapadia 2020 126} suggested reduced rates of suctioning over time possibly in response to changing guidelines. Clearly worded, unambiguous recommendations may help with implementation. |

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| Monitoring and evaluation |
| Auditing of when and why suctioning is performed may support practice change and provide valuable information for research. |

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| Research priorities |
| The role of suctioning of clear amniotic fluid at birth for infants at higher risk of needing resuscitation or respiratory supportThe role of suctioning of clear amniotic fluid at birth for preterm infants  * Adherence to resuscitation guidelines in relation to the practice of suctioning clear amniotic fluid |

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