**Detection and survival of SARS in human stool, urine, wastewater and sludge**

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**SUPPLEMENTARY MATERIAL**

**Supplementary Table 1: Detection of SARS-CoV-1 from stool and urine.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference | Sample type: stool/urine/anal swab | CoV Detection (RT-qPCR)  (Data on length of shedding if available) | CoV Detection (RT-PCR)  (Data on length of shedding if available) | Notes | Country |
| [(Zhai et al., 2004)](http://sciwheel.com/work/citation?ids=8565621&pre=&suf=&sa=0) | Stool |  | n= 326 patients; n = 326 samples  Days after onset: CoV+ Stool/Total  1-10d: 10/37 (27.0%)  11-20d: 19/71 (26.8%)  21-30d: 12/77 (15.6%)  31-40d: 12/67 (17.9%)  >40d: 7/74 (9.5%)  18% of fecal samples contained SARS-CoV RNA >31–40 days after onset of symptoms | Methods missing, unclear if number of patients equals number of samples or whether people were resampled. | USA, China |
| [(Ren et al., 2003)](http://sciwheel.com/work/citation?ids=8569867&pre=&suf=&sa=0) | Stool |  | n = 46 patients, n = 103 samples  n = 29/46 (63.0%) CoV+  Duration of positive cases 31.76 +/- 10.78 days (12-64 d) | Abstract only | China |
| [(Vabret et al., 2006)](http://sciwheel.com/work/citation?ids=8548163&pre=&suf=&sa=0) | Stool |  | n = 6 patients (5 Children, 1 Adult) n= 6 samples  n = 2/6 (33.3%) CoV+ |  | France |
| [(Peiris et al., 2003)](http://sciwheel.com/work/citation?ids=3887061&pre=&suf=&sa=0) | Stool &  Urine |  | n = 75 patients, n= 67 samples  Stool: 65/67 (97.0%) CoV+ on day 14  Urine: 31/74 (41.9%) CoV+ on day 14 |  | China |
| [(Poon et al., 2004)](http://sciwheel.com/work/citation?ids=8535508&pre=&suf=&sa=0) | Stool | Subsample of 37 seropositive patients compared RT-qPCR & PCR  n = 37 samples  n = 26/37 (70%) CoV+  Days after onset: CoV+/Total  1–3 : 4/6 (66.7%)  4–6 : 12/15 (80.0%)  7–10: 10/16 (62.5%) | n = 44 samples from seropositive CoV+ patients  n = 25/44 (56.8%) CoV+  Days after onset: CoV+/Total (ORF1b region)  1–3 : 2/8 (25.0%)  4–6 : 10/17(58.8%)  7–10: 13/19 (68.4%)    Subsample of 37 seropositive patients compared RT-qPCR & PCR  n = 37 samples  n = 22/37 (59%) CoV+  Days after onset: CoV+/Total  1–3 : 2/6 (33.3%)  4–6 : 10/15 (66.7%)  7–10: 10/16 (62.5%) | Samples collected within 10 days of disease onset.  Detection rate in stool increased as disease progressed  Method is unclear. | China |
| [(Chan et al., 2004)](http://sciwheel.com/work/citation?ids=1685388&pre=&suf=&sa=0) | Stool  Urine |  | n = 386 patients CoV+  Stool: 5/25 (20.0%) CoV+ before day 5 (serologically confirmed case)  Urine: 0/15 (0%) CoV+ before day 5 (serologically confirmed case)  n = 1/184 (<1%) CoV+ in presumed CoV- patients.  Stool  Samples up until day 5, 0% CoV+ (from graph)  Samples day 11-12 over 90% (348 samples) CoV+ (from graph)  Samples after day 30 approx 10% CoV+ (39 samples) (from graph)  Urine  Up to day 7, 0% CoV+  Day 7 - 8 under 10% CoV+  Day 11 - 12, >40% <50% CoV+  After day 30 approx 5% CoV+ | Data extracted from Figure. | China |
| [(Leung et al., 2003)](http://sciwheel.com/work/citation?ids=8538037&pre=&suf=&sa=0) | Stool |  | n = 124 patients  n = 20/124 (16.1%) CoV+  Viral RNA detected in stool up to 73 days (10 weeks) after onset of symptoms. |  | China |
| [(Hung et al., 2004)](http://sciwheel.com/work/citation?ids=8573637&pre=&suf=&sa=0) | Stool  Urine | Stool:  n = 94 samples  n= 82/94 (87.2%) CoV+ Mean viral load in log10 copies/mL (SD) n=82:  Stool: 7.0 (2.1)  -diarrhea: 7.5  -no diarrhea: 5  Urine:  n = 111 urine samples  n= 32/111 (28.8%) CoV+ Mean viral load in log10 copies/mL (SD), n=32:  Urine: 4.4 (1.3) | Stool:  n = 94 samples  n = 42/94 (44.7%) RT-PCR  Urine:  n = 111 urine samples  n = 29/111 (27%) RT-PCR  n = 1/20 (5%) CoV+culture | Day 10 to 15 after onset of symptoms | China |
| [(He et al., 2004)](http://sciwheel.com/work/citation?ids=8402044&pre=&suf=&sa=0) | Stool | Days after onset of fever: CoV+/total patients::  10-55d: 58/101 (57.4%)  10-19d: 8/8 (100%)  20-29d: 21/31 (67.7%)  30-39d: 27/57 (47.4%)  40-55d: 2/5 (40.0%) |  | Abstract only  Showed the viral load to be highest in the acute phase | China |
| [(Study group of SARS, 2004)](http://sciwheel.com/work/citation?ids=8657596&pre=&suf=&sa=0) | Stool  Urine | n = 531 samples from n = 177 SARS antibody positive patients  n = 26/177 (14.7%) positive in urine  n = 21/177 (11.9%) positive in stool  The quantity of SARS-CoV RNA in samples was 100-47,000 copies/ml  No significant difference was found among urine and stool. |  | Abstract only.  Convalescent Patients | China |
| [(Liu et al., 2004)](http://sciwheel.com/work/citation?ids=8402047&pre=&suf=&sa=0) | Stool |  | n = 56 patients, n = 514 stool samples  n= 56/56 patients CoV+ within the first 20 days.  4/56 (7.1%) CoV+ >100 days after disease onset.  The median (range) duration between onset of symptoms and first positive RT-PCR test result was 6 (3–10) days for stool.  Duration of virus excretion in stool  n = 27 (16-126) days. Duration was marked by the first of three consecutive negative tests for SARS-CoV RNA. | Coexisting illness or conditions were associated with longer viral excretion in stools.  Methods unclear. | China, France |
| [(Wong et al., 2003)](http://sciwheel.com/work/citation?ids=8499032&pre=&suf=&sa=0) | Stool |  | n = 4 patients  3/4 (75.0%) CoV+, Days 2 - 9 |  | China |
| [(Wang et al., 2005a)](http://sciwheel.com/work/citation?ids=8193414&pre=&suf=&sa=0) | Stool  Urine |  | n = 11 samples from active patients  n = 10 samples from recovered patients  Stool:  7/11 (63.6%) CoV+ in active infections  0/10 (0%) stool positive for viral RNA in recovered patients  Urine:  0/21 (0%) urine positive for viral RNA |  | China |

**Supplementary Table 2:** **Detection of SARS-CoV-2 from stool and urine.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference | Sample type: stool/urine/anal swab | CoV Detection (RT-qPCR)  (Data on length of shedding if available) | CoV Detection (RT-PCR)  (Data on length of shedding if available) | Notes | Country |
| [(Holshue et al., 2020)](http://sciwheel.com/work/citation?ids=8167980&pre=&suf=&sa=0) | Stool | n = 1 patient  100% CoV+ on day 6 after infection |  | First report of COVID in U.S. | USA |
| [(Wang et al., 2020)](http://sciwheel.com/work/citation?ids=8411087&pre=&suf=&sa=0) | Stool  Urine | Stool:  n = 153 specimens  44/153 (28.7%) CoV+  Urine:  n = 72 specimens  0/72 (0%) CoV+ |  | Ct <40 +ve result | China |
| [(Zhang et al., 2020a)](http://sciwheel.com/work/citation?ids=8415785&pre=&suf=&sa=0) | Stool |  | n = 14 patients  5/14 (35.7%) CoV+ |  | China |
| [(Tang et al., 2020)](http://sciwheel.com/work/citation?ids=8415671&pre=&suf=&sa=0) | Stool  Urine |  | n = 1 patient (Child)  Stool:  6/8 (75%) samples CoV+  Urine  0/1 (0%) samples CoV+  Day 1 after infection:  ORF1ab Ct 26.3; nucleoprotein Ct 27.6  Day 2  ORF1ab Ct 31.4; nucleoprotein Ct 30.6  Day 3:  ORF1ab Ct 27.0; nucleoprotein Ct 27.0 |  | China |
| [(Kam et al., 2020)](http://sciwheel.com/work/citation?ids=8404931&pre=&suf=&sa=0) | Stool  Urine | n = 1 patient (infant)  From day of admission to hospital  Stool, n=2  n=1/2 CoV+  Urine, n=1  n= 0-1 CoV+ |  |  | Singapore |
| [(Chen et al., 2020b)](http://sciwheel.com/work/citation?ids=8382681&pre=&suf=&sa=0) | Anal Swab | n = 28 patients  n = 11/28 (39.2%) CoV+  Day 10: Ct 24+39 |  |  | China |
| [(Ling et al., 2020)](http://sciwheel.com/work/citation?ids=8415787&pre=&suf=&sa=0) | Stool & Urine |  | n = 66 patients  Stool:  11/66 (16.7%) CoV+  43/55 (78.1%) CoV+ longer than in throat swabs (median 2.0 (1.0-4.0) days).  Urine:  4/58 (6.9%) CoV+  3/4 (75.0%) CoV+ after throat swabs turned negative | Methods are unclear | China |
| [(Young et al., 2020)](http://sciwheel.com/work/citation?ids=8373364&pre=&suf=&sa=0) | Stool  Urine | Stool:  4/8 (50.0%) patients CoV+  Urine:  0/8 (0%) CoV+ |  |  | Singapore |
| [(Xiao et al., 2020b)](http://sciwheel.com/work/citation?ids=8439845&pre=&suf=&sa=0) | Stool |  | n = 71 patients  Stool:  n = 39/71 (53.4%) CoV+  17/39 (43.6%) remained positive after showing negative respiratory results. |  | China |
| [(Xu et al., 2020)](http://sciwheel.com/work/citation?ids=8419628&pre=&suf=&sa=0) | Anal Swab | n = 10 children,  8/10 children CoV+ in stool  Rectal swabs remained CoV+ until day 27 on average |  |  | China, USA |
| [(Zhang et al., 2020a)](http://sciwheel.com/work/citation?ids=8415785&pre=&suf=&sa=0) | Stool |  | n = 14 patients  Stool:  5/14 (35.7%) CoV+ | When CoV- stool samples, also CoV- for oropharyngeal swabs. | China |
| [(Xing et al., 2020)](http://sciwheel.com/work/citation?ids=8498743&pre=&suf=&sa=0) | Stool | n = 3 patients (children)  Patients 1 and 2:  Pt 1: CoV+ day 4 to 23 inclusive  Pt 2: CoV+ day 4 to 33 inclusive  Pt 1: discharge day 27  Pt 2: discharge day 26  Patient 3:  Pt 3: CoV+ day 25 to 30 after admission. |  | PREPRINT | China |
| [(Kujawski et al., 2020)](http://sciwheel.com/work/citation?ids=8496314&pre=&suf=&sa=0) | Stool  Urine | n = 10 patients  Stool:  n = 7/10 (70.0%) CoV+  Most CoV+ when CoV+ in respiratory tract.  CoV+ up to day 25 (Median 14 days)  Urine:  n = 0/10 (0%) urine CoV+ |  | PREPRINT  First 12 positive patients in US  Serial testing to determine duration RNA detection and viral shedding ongoing. | USA |
| [(Wölfel et al., 2020)](http://sciwheel.com/work/citation?ids=8551661&pre=&suf=&sa=0) | Stool  Urine | n = 9 patients  Stool:  n=59 samples  9/9 (100%) patients CoV+  57/59 CoV+ samples  Last CoV+ swab day 28  Urine:  n = 0/27 (0%) samples CoV+  (From Graph) |  | PREPRINT  Stool and sputum samples RNA CoV+ over three weeks in 6/9 patients in spite of full resolution of symptoms.  Methods state RT-PCR was used, but quantification was presented indicating RT-qPCR  Data extracted from Figure. | Germany, UK |
| [(Wu et al., 2020b)](http://sciwheel.com/work/citation?ids=8496310&pre=&suf=&sa=0) | Stool | n = 10 children, Serologically CoV+  Stool  n = 8/10 (80.0%) patients CoV+ |  | PREPRINT | China |
| [(Cai et al., 2020)](http://sciwheel.com/work/citation?ids=8419966&pre=&suf=&sa=0) | Stool (method unstated)  Urine | n = 6 children 3 - 5 days after illness onset  Stool:  5/6 (83.3%) patients CoV+  Urine:  0/6 (0%) CoV+ |  | PREPRINT | China |
| [(Chan et al., 2020)](http://sciwheel.com/work/citation?ids=8133898&pre=&suf=&sa=0) | Stool  Urine |  | n = 3 patients  Stool:  0/3 (0%) patients CoV+  Urine:  0/3 (0%) patients CoV+ |  | China |
| [(Zhang et al., 2020b)](http://sciwheel.com/work/citation?ids=8694830&pre=&suf=&sa=0) | Stool  Urine | Stool:  n = 12 patients, n = 51 samples  10/12 (83.3%) patients CoV+ stool  2/23 (8.7%) patients CoV+ 16 and 21 days after hosp.admission.  Median Duration of Shedding  22 days fecal  Urine:  n = 23 patients  2/23 (8.7%) CoV+ |  | PREPRINT  Results were unclear. | China |
| [(Lo et al., 2020)](http://sciwheel.com/work/citation?ids=8546479&pre=&suf=&sa=0) | Stool & Urine | n = 10 patients  Stool samples  46/79 (58%) CoV+  Patient 1: 1/8 (12.5%) CoV+  Patient 2: 7/10 (70.0%) CoV+  Patient 3: 4/6 (66.7%) CoV+  Patient 4: 3/3 (100%) CoV+  Patient 5: 5/8 (62.5%) CoV+  Patient 6: 4/6 (66.7%) +1 inconclusive CoV+  Patient 7: 5/8 (62.5%) +1 inconclusive CoV+  Patient 8: 6/8 (75.0%) CoV+  Patient 9: 10/10 (100%) CoV+  Patient 10: 1/12 (8.3%) +9 inconclusive CoV+  Ct <= 35 is positive test  Ct > 38 negative test  Ct 36 to 38 required confirmation by retesting and was reported as inconclusive.  Urine:  n=0/49 (0%) CoV+ |  |  | China |
| [(Lescure et al., 2020)](http://sciwheel.com/work/citation?ids=8527129&pre=&suf=&sa=0) | Stool  Urine | n = 2 patients  Stool:  Patient 4: viral load max 6.8 log10 copies/g  Patient 5: viral load max 8.1 log10 copies/g | n = 5 patients  Stool:  n = 2/5 patients CoV+  n = 11/22 (50%) samples CoV+  Patient 1: 0/6 (0%) CoV+  Patient 2: 0/1 (0%) CoV+  Patient 3: 0/4 (0%) CoV+  Patient 4: 6/6 (100%) CoV+  Patient 5: 5/5 (100%) CoV+  Urine:  0/5 (0%) Patients CoV+  n = 0/13 (0%) samples CoV+ | PREPRINT  RT-PCR used as a screening test followed by RT-qPCR for testing viral loading | France |
| [(Chen et al., 2020a)](http://sciwheel.com/work/citation?ids=8622610&pre=&suf=&sa=0) | Stool | n = 19 patients, n = 74 faecal samples  Stool samples taken after first negative pharyngeal/sputum sample  n = 13/19 (68.4%) patients CoV+  n = 18/74 (24.3%) samples CoV+  Patient 1: 1/2 (20.0%)  Patient 2: 1/4 (25.0%)  Patient 3: 1/7 (14.3%)  Patient 4: 1/6 (16.7%)  Patient 5: 1/3 (33.3%)  Patient 6: 2/3 (66.6%)  Patient 7: 2/8 (25.0%)  Patient 8: 1/2 (50%)  Patient 9: 0/3 (0.0%)  Patient 10: 0/2 (0.0%)  Patient 11: 1/6 (16.7%)  Patient 12: 0/6 (0.0%)  Patient 13: 0/5 (0.0%)  Patient 14: 0/2 (0.0%)  Patient 15: 0/2 (0.0%)  Patient 16-18: N/A  Patient 19: 2/2 (100%)  Patient 20: 1/1 (100%)  Patient 21: 1/2 (50%)  Patient 22: 3/3 (100%) |  | Low detection in stool due to sample collection following first CoV- pharyngeal or sputum test. | China |
| [(Wu et al., 2020c)](http://sciwheel.com/work/citation?ids=8496740&pre=&suf=&sa=0) | Stool | n = 98 patients CoV+ (nasopharyngeal)  Stool  n = 41/74 (55.4%) patients CoV+  Nasopharyngeal CoV+ mean 16.7 days  Stool CoV+ mean 27.9 days |  | CORRESPONDENCE  Fecal samples CoV+ after NP samples CoV- | China, USA |
| [(Pan et al., 2020)](http://sciwheel.com/work/citation?ids=8527116&pre=&suf=&sa=0) | Stool | Stool  n = 17 patients (Day 0-13 post onset)  9/17 (52.9%) CoV+  550 copies to 1.21 x 10^5 copies/ml |  | CORRESPONDENCE  Data fairly sparse. No methodology | China |
| [(Zhang et al., 2020c)](http://sciwheel.com/work/citation?ids=8389981&pre=&suf=&sa=0) | Anal Swab | n =15 patients after 0 days treatment 4/15 (27%) CoV+ by RT-qPCR  Ct  Patient 3: 19.5  Patient 4: 30.2  Patient 5: 33.1  Patient 9: 33.6  n= 16 patients after 10 days treatment (day 5)  9/16 CoV+ by RT-qPCR  Ct  Patient 5: 33.1  Patient 6: 31.4  Patient 7: 30.2  Patient 8: 33.1  Patient 10: 23.8  Patient 13: 17.8  Patient 14: 25.5  Patient 15: 30.0  Patient 16: 27.5 |  |  | China |
| [(Zheng et al., 2020)](http://sciwheel.com/work/citation?ids=8753120&pre=&suf=&sa=0) | Stool  Urine |  | n = 96 patients CoV+  Stool  n = 55/93 (59%) CoV+  Urine  n = 1/67 (0.1%) CoV+ | CoV+ if Ct threshold <= 38.0  Median duration virus in stool 22 days  Median duration virus in resp 18 days  CoV+ in urine in severe case only | China |
| [(Xiao et al., 2020a)](http://sciwheel.com/work/citation?ids=8918645&pre=&suf=&sa=0) | Stool | n = 28 patients  n = 12/28 CoV+  One patient from the 28 Ct |  |  | China |

**Supplementary Table 3: Culture of SARS-CoV-1 from stool/urine or wastewater.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reference | Sample type: stool/urine/anal swab | SARS-CoV-1 culture | Notes | Country |
| [(Leung et al., 2003)](http://sciwheel.com/work/citation?ids=8538037&pre=&suf=&sa=0) | Stool | Undefined number of attempts to culture. None were successful. |  | China |
| [(Wang et al., 2005c)](http://sciwheel.com/work/citation?ids=8280380&pre=&suf=&sa=0) | Spiked Stool  Urine  Wastewater | Positive Virus Detection:  Temp = 20C  309th Hospital wastewater: 2d (n = 3/9 (33.3%) samples CoV+)  Domestic sewage: 2d (n = 3/9 (33.3%) samples CoV+)  Temp = 4C  309th Hospital wastewater: 14d (n = 9/9 (100%) samples CoV+)  Domestic sewage: 14d (n = 9/9 (100%) samples CoV+)  Temp = 20C  Stool: 3d (n = 9/30 (30.0%) samples CoV+)  Urine: 17d (n = 20/20 (100%) samples CoV+) |  | China |
| [(Hung et al., 2004)](http://sciwheel.com/work/citation?ids=8573637&pre=&suf=&sa=0) | Stool  Urine | Stool:  n = 1/20 (5.0%) CoV+ culture stool  Urine:  n = 1/20 (5.0%) CoV+ culture urine |  | China |
| [(Liu et al., 2004)](http://sciwheel.com/work/citation?ids=8402047&pre=&suf=&sa=0) | Stool | n = 0/12 (0%) CoV+ isolation from RT-PCR–positive stool specimens > 6 weeks after disease onset. |  | China, France |
| [(Wang et al., 2005b)](http://sciwheel.com/work/citation?ids=8280332&pre=&suf=&sa=0) | Sewage | “All sewage samples tested for the presence of infectious SARS-CoV in cell culture were negative” | Methods not detailed enough. | China |
| [(Wang et al., 2004)](http://sciwheel.com/work/citation?ids=8286625&pre=&suf=&sa=0) | Sewage  2 x Hospital | n = 12 samples  0/12 (0%) CoV+ infectious virus | Chinese paper, English abstract | China |
| [(Wang et al., 2005d)](http://sciwheel.com/work/citation?ids=8280340&pre=&suf=&sa=0) | Sewage: Hospital | Temp: 4C  CoV+ infectious virus: 14 days (n = 9/9 (100%) samples CoV+)  Temp: 20C  CoV+ infectious virus: 2 days (n = 3/9 (33.3%) samples CoV+) | CoV+ RNA detection in 20C samples for 8 days. | China |
| [(Wang et al., 2005a)](http://sciwheel.com/work/citation?ids=8193414&pre=&suf=&sa=0) | Stool  Urine  Sewage | n = 21 samples  n = 11 samples from active patients  n = 10 samples from recovered patients  0/21 Stool positive for infectious SARS-CoV-1  0/21 Urine positive for infectious SARS-CoV-1  n = 12 sewage samples (over 7 days and 2 hospitals)  0/12 sewage samples positive for infectious SARS-CoV-1 | Methodology not clear | China |

**Supplementary Table 4: Culture of SARS-CoV-2 from stool/urine or wastewater.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Reference | Sample type | CoV culture | Notes | Country |
| [(Zhang et al., 2020d)](http://sciwheel.com/work/citation?ids=8573292&pre=&suf=&sa=0) | Stool | n = 1 patient  100% CoV+ | First paper to demonstrate recovery of infectious virus from stool. Electron microscopy verification. | China |
| [(Wölfel et al., 2020)](http://sciwheel.com/work/citation?ids=8551661&pre=&suf=&sa=0) | Anal swab | n = 13 samples from n = 4 patients over 6 - 12 weeks  0/13 (0%) CoV-2+ | Samples containing <10^6 copies/mL (or copies per sample) never yielded an isolate.  However, CoV+ cultures obtained from oral or nasopharyngeal swabs (16.7%) and sputum (83.3%) | Germany, UK |
| [(Wang et al., 2020)](http://sciwheel.com/work/citation?ids=8411087&pre=&suf=&sa=0) | Stool | n = 4 patients  2/4 (50%) CoV-2+ | Verified intact virus by electron microscope | China |
| [(Sun et al., 2020)](http://sciwheel.com/work/citation?ids=8826865&pre=&suf=&sa=0) | Urine | n = 1 patient  1/1 (100%) CoV-2+ | CoV+ on day 12 post infection up until day 42. RT-PCR positive urine specimens (Ct 34) from day 12 p.i. was serially diluted in infection media and inoculated onto Vero E6 cells. Cytopathic effects were clearly observed after 3 days. | China |
| [(Rimoldi et al., 2020)](http://sciwheel.com/work/citation?ids=8919994&pre=&suf=&sa=0) | 3 x WWTW (Influent and Effluent)  2 x Rivers  (WWTW A & B discharge to Lambro River  WWTW C discharges to Lambro Meridionale River) | n = 16 samples (Over two different days)  0/16 (0%) CoV-2+ | PREPRINT  No positive cultures detected 48 and 72 hrs after inoculation. | Italy |
| [(Xiao et al., 2020a)](http://sciwheel.com/work/citation?ids=8918645&pre=&suf=&sa=0) | Stool | n = 3 patients  2/3 cultures CoV+ | Detection of virus particles using transmission electron microscopy after 72 hours | China |

**Supplementary Table 5:** **Detection of SARS-CoV-1 from wastewater.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference | Wastewater Source1 | Method of CoV detection | CoV Detection | Notes | Country |
| [(Wang et al., 2005c)](http://sciwheel.com/work/citation?ids=8280380&pre=&suf=&sa=0) | Hospital wastewater  Domestic sewage | RT-PCR | Temp: 20C  1x Hospital wastewater CoV+  1 x Domestic sewage  CoV+ |  | China |
| [(Wang et al., 2005b)](http://sciwheel.com/work/citation?ids=8280332&pre=&suf=&sa=0) | 2 x Hospitals  1 x Housing estate | RT PCR | Confirmed presence of CoV+ in hospital sewage | Methods/Results unclear | China |
| [(Wang et al., 2004)](http://sciwheel.com/work/citation?ids=8286625&pre=&suf=&sa=0) | Hospital sewage | RT-PCR | n = 12/12 (100%) | 1/10 positive in sewage after disinfection | China |
| [(Wang et al., 2005d)](http://sciwheel.com/work/citation?ids=8280340&pre=&suf=&sa=0) | 2 x Hospitals | RT-PCR | Confirmed presence of CoV+ in hospital sewage | Methods/Results unclear | China |

1 Description of the nature of the dataset collected: virus spiked into lab-created wastewater (i.e., Lab) or natural abundance of CoV in wastewater collected from plumbing/wastewater/river (i.e., Environment).

**Supplementary Table 6: Detection of SARS-CoV-2 from wastewater**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Reference | Wastewater Source1 | Method of CoV Detection | CoV Detection | Notes | Country |
| [(Wu et al., 2020a)](http://sciwheel.com/work/citation?ids=8622602&pre=&suf=&sa=0) | WWTP x 1 (From two catchments) | RT-qPCR | n = 10/14 (71.4%) samples  7/10 hitting all three primers with an average Ct for all samples below 40 | Post 1st US SARS-CoV-2 case | USA, Singapore |
| [(Ahmed et al., 2020)](http://sciwheel.com/work/citation?ids=8714792&pre=&suf=&sa=0) | 2 x WWTP (A & B)  1 x Pumping station | RT-qPCR | n = 9 wastewater samples tested (WWTP A,B; Pumping Station)  n = 2/9 (22.2 %) samples WWTP B CoV+  Pumping station and WWTP A CoV- |  | USA, Australia, Japan |
| [(Medema et al., 2020a)](http://sciwheel.com/work/citation?ids=8573247&pre=&suf=&sa=0) and [(Medema et al., 2020b)](http://sciwheel.com/work/citation?ids=8971090&pre=&suf=&sa=0) | 7 x WWTP in 5 cities (2 large and 3 medium size)  1 x airport | RT-PCR | 3 weeks prior to epidemic:  0/6 CoV+  Week 1 of epidemic:  n = 4/6 (66.6%) CoV+  Week 3 of epidemic:  n = 6/7 (85.7%) CoV+  Detection varied by primer:  n = 5/7 (71.4%) CoV+ N3  n = 4/7 (57.1%) CoV+ E primer/probe |  | The Netherlands |
| [(Wurtzer et al., 2020)](http://sciwheel.com/work/citation?ids=8733257&pre=&suf=&sa=0) | 3 x WWTP (Parisian area) | RT- qPCR | n = 23/23 (100%) raw sewage CoV+  n = 6/8 (75%) treated sewage CoV+ | PREPRINT  CoV+ quantity in WWTP effluent is 100 x lower than influent. | France |
| [(Nemudryi et al., 2020)](http://sciwheel.com/work/citation?ids=8750435&pre=&suf=&sa=0) | 1 x WWTP influent | RT-PCR  RT-qPCR | n = 7 sampling days over 17 days  5/5 (100%) CoV+ composite sampling days  Viral abundance:  N1: 100 to 1700 viral genomes/L  N2: 100 to 500 viral genomes/L  2/2 CoV+ grab sampling days  Viral abundance:  N1: 8,000 to 9,000 viral genomes/L  N2: 9,0000 to 23,000 | PREPRINT  SARS-CoV-2 detected over the entire time course. Viral RNA (N1) steadily decreased over the last week.  Viral genomes/L deduced from Figure. | USA |
| [(Randazzo et al., 2020)](http://sciwheel.com/work/citation?ids=8784925&pre=&suf=&sa=0) | 6 x WWTP in two cities  Influent  Secondary Treatment  Tertiary Treatment | RT-qPCR | n = 42 influent samples  n = 18 secondary treatment samples  n = 12 tertiary treatment samples  Untreated wastewater:  5.29log genomic copies/l  Influent:  n = 36/42 (85.7%) CoV+  12% samples CoV+ Ct 37 - 40  29% samples CoV+ Ct 34 - 37  Secondary /Tertiary treatment  n =0/42 (0%) CoV+ (Ct <40) | PREPRINT | Spain |
| [(La Rosa et al., 2020)](http://sciwheel.com/work/citation?ids=8802710&pre=&suf=&sa=0) | 2 x WWTPs in Milan  1 x WWTP in Rome | RT-PCR | n = 12 composite influent  6/12 (50%) CoV+ | PREPRINT | Italy |
| [(Bar Or et al., 2020)](http://sciwheel.com/work/citation?ids=8868998&pre=&suf=&sa=0) | 17 x WWTW (Influent)  2 x Hospital Effluent (In sewer)  3 x Isolation facilities (In sewer) | RT-qPCR | n = 17 WWTW samples (influent)  3/17 (17.6%) CoV+ (Ct <40)  (Ct = 38.5, 34.7, 37.0)  n = 2 Hospital sewer network  1/2 CoV+ (Ct<40)  (Ct = 33.2)  n = 4 Sewer network  3/4 CoV+ (Ct<40)  (Ct 37.24, 35.57, 33.75)  n = 3 Isolation facilities sewer network  3/3 CoV+ (Ct<40)  (Ct 38.03, 35.51, 32.76) | PREPRINT | Israel |
| [(Alpaslan Kocamemi et al., 2020a)](http://sciwheel.com/work/citation?ids=8869010&pre=&suf=&sa=0) | 7 X WWTW (Influent)  2 x Manholes | RT-qPCR | n = 5/7 (71.4%) WWTW CoV+  (Cq 38.37, 37.23, 38.82, 39.18, 39.54)  n = 2/2 Manholes CoV+  (Cq 35.91, 34.67)  n = 5/7 (71.4%) WWTW Viral genome detected (titre/l)  8.26 E+03  1.80 E+04  4.95 E+03  3.73 E+03  2.89 E+03  n = 2/2 Manholes Viral genome detected (titre/l)  4.49 E+04  9.33 E+04 | PREPRINT  SARS-CoV-2 titres greater in manhole sewage to that for WWTW | Turkey |
| [(Lodder and de Roda Husman, 2020)](http://sciwheel.com/work/citation?ids=8566238&pre=&suf=&sa=0) | 1 x WWTW | RT-qPCR | n = unknown. At least 3  Weekly 24hr samples  n= 1/3 CoV+ | CORRESPONDENCE  No methodology  Wastewater sample CoV+ve 4 days after 1st CoV+ person in NL | The Netherlands |
| [(Alpaslan Kocamemi et al., 2020b)](http://sciwheel.com/work/citation?ids=8917517&pre=&suf=&sa=0) | 7 x WWTW (2 Primary Sludge; 7 Waste Activated Sludge) | RT-qPCR  Copy Numbers of Genome | n = 2/2 Primary Sludge CoV+  (Cq 35.96, 34.71)  n = 7/7 Waste Activated Sludge CoV+ (Cq 35.67, 35.00, 34.98, 34.74, 34.61, 34.11, 33.52)  Primary Sludge Viral genome detected (titre/l)  1.41E+03  8.60E+02  Waste Activated Sludge Viral genome detected (titre/l)  1.17E+04  1.62E+04  1.64E+04  1.91E+04  1.95E+04  3.08E+04  4.02E+04 | PREPRINT | Turkey |
| [(Rimoldi et al., 2020)](http://sciwheel.com/work/citation?ids=8919994&pre=&suf=&sa=0) | 3 x WWTW (Influent and Effluent)  2 x Rivers  (WWTW A & B discharge to Lambro River  WWTW C discharges to Lambro Meridionale River) | RT-qPCR | 1st Day Sampling  n = 3/3 CoV+ Raw Sewage  n = 0/3 CoV+ Treated Sewage  n = 2/2 CoV+ River Samples (Lambro and Lambro Meridonale Rivers)  2nd Day Sampling  n = 1/3 CoV+ Raw Sewage *(CoV+ From WWTW B which discharges to Lambro River)*  n = 0/3 CoV+ Treated Sewage  n = 1/2 CoV+ River Samples  *(Lambro River)* | PREPRINT  No Cq results  Second day sampling raw and river samples CoV+ for discharge from WWTW B to Lambro River | Italy |
| [(Peccia et al., 2020)](http://sciwheel.com/work/citation?ids=8946881&pre=&suf=&sa=0) | Primary Sludge  1 x WWTW | RT-qPCR | n = 36 samples taken over 36 days  n = 36/36 (100%) CoV+ | PREPRINT  Solids content of sludge - 2.6 - 5%  Over 96.5% all CoV+ samples Ct less than 38  Ct 38 - 40 deemed CoV+ only if detection occurred with virus nucleocapsids N1 and N2 primer sets and both replicates. | USA |

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