



Draft Genome Sequence of C:P1.5-1,10-8:F3-6:ST-11 Meningococcal Clinical Isolate Associated with a Cluster on a Cruise Ship

A. Neri, a C. Fazio, a A. Ciammaruconi, b A. Anselmo, b A. Fortunato, b A. Palozzi, b P. Vacca, a S. Fillo, b F. Lista, b P. Stefanellia

Department of Infectious, Parasitic & Immuno-mediated Diseases, Istituto Superiore di Sanità, Rome, Italy^a; Army Medical and Veterinary Research Center, Rome, Italy^b A.N. and C.F. contributed equally to this work.

Meningococcal serogroup C strains, in particular those belonging to the ST-11 clonal complex, are known to cause invasive diseases worldwide. We report the genome sequence of a *Neisseria meningitidis* strain linked to a cluster of cases of invasive meningococcal disease on a cruise ship that was described in 2012.

Received 23 October 2014 Accepted 24 October 2014 Published 4 December 2014

Citation Neri A, Fazio C, Ciammaruconi A, Anselmo A, Fortunato A, Palozzi A, Vacca P, Fillo S, Lista F, Stefanelli P. 2014. Draft genome sequence of C:P1.5-1,10-8: F3-6: ST-11 meningococcal clinical isolate associated with a cluster on a cruise ship. Genome Announc. 2(6):e01263-14. doi:10.1128/genomeA.01263-14.

Copyright © 2014 Neri et al. This is an open-access article distributed under the terms of the Creative Commons Attribution 3.0 Unported license.

Address correspondence to P. Stefanelli, paola.stefanelli@iss.it.

Meningococcal serogroup C strains belonging to the ST-11 clonal complex (cc) are known to cause invasive diseases worldwide (1, 2). Several reports indicate an increase of severe cases and outbreaks of invasive diseases due to serogroup C meningococci belonging to ST-11 cc, characterized by a high mortality rate (3–5). A cluster of four cases of invasive meningococcal disease due to *N. meningitidis* of serogroup C ST-11 cc that occurred on a cruise ship in October 2012 was reported in Italy (6).

Here, the draft genome sequence of one of the four *N. meningitidis* strains, C:P1.5-1,10-8:F3-6:ST-11, isolated from a patient who died, is described.

Genomic DNA was extracted using QIAamp DNA minikit (Qiagen, Hilden, Germany) from an overnight culture grown on Thayer Martin agar. Whole-genome sequencing was performed using Illumina MiSeq sequencer, which generated 2,023,619 total reads (1,752,365 after trimming) with an average length of 180 \times 2 nucleotides (nt) (~613 Mb). A second sequencing run was performed using a whole-genome shotgun strategy with a Roche genome sequencer (GS) FLX 454 FLX+ (Roche, Basel, Switzerland). In this second sequencing run, 71,631 reads were generated, with an average length of 550 nt (~40 Mb). The final coverage was 297×. De novo assemblies of Illumina and Roche reads were performed by ABySS software version 1.3.5 (7) and GS De Novo Assembler version 2.8 (454 Life Science, Branford, CT, USA), respectively. The resulting contigs from both sequencings were merged when overlapping using Minimus2 software (8): the final number of contigs was 102, and the draft genome sequence was 2,190,379 bp long.

The 102 contigs were submitted to the NCBI whole-genome shotgun (WGS) submission portal (https://submit.ncbi.nlm.nih.gov/subs/wgs/), and the sequence was annotated using the NCBI Prokaryotic Genome Automatic Annotation Pipeline (PGAAP) (http://www.ncbi.nlm.nih.gov/genome/annotation_prok/).

Nucleotide sequence accession numbers. This whole-genome shotgun project has been deposited at DDBJ/EMBL/GenBank under the accession no. JPTA000000000. The version described in this paper is version JPTA01000000.

ACKNOWLEDGMENTS

This publication made use of the *Neisseria* multilocus sequence typing website developed by Keith Jolley and located at the University of Oxford (9). The development of this site has been funded by the Wellcome Trust and European Union.

This work was funded by the Ministry of Health-CCM Project "Sorveglianza delle malattie invasive da *Neisseria meningitidis*, *Streptococcus pneumoniae* ed *Haemophilus influenza*," 2014–2015.

REFERENCES

- Watkins ER, Maiden MC. 2012. Persistence of hyperinvasive meningococcal strain types during global spread as recorded in the PubMLST database. PLoS One 7:e45349. http://dx.doi.org/10.1371/journal.pone.0045349.
- Deghmane AE, Parent du Chatelet I, Szatanik M, Hong E, Ruckly C, Giorgini D, Lévy-Bruhl D, Alonso JM, Taha MK. 2010. Emergence of new virulent Neisseria meningitidis serogroup C sequence type 11 isolates in France. J. Infect. Dis. 202:247–250. http://dx.doi.org/10.1086/653583.
- 3. Smith I, Caugant DA, Høiby EA, Wentzel-Larsen T, Halstensen A. 2006. High case-fatality rates of meningococcal disease in western Norway caused by serogroup C strains belonging to both sequence type (ST)-32 and ST-11 complexes, 1985–2002. Epidemiol. Infect. 134:1195–1202. http://dx.doi.org/10.1017/S0950268806006248.
- Perrocheau A, Taha MK, Levy-Bruhl D. 2005. Epidemiology of invasive meningococcal disease in France in 2003. Euro Surveill. 10:238–241.
- Zarantonelli ML, Lancellotti M, Deghmane AE, Giorgini D, Hong E, Ruckly C, Alonso JM, Taha MK. 2008. Hyperinvasive genotypes of *Neisseria meningitidis* in France. Clin. Microbiol. Infect. 14:467–472. http://dx.doi.org/10.1111/j.1469-0691.2008.01955.x.
- Stefanelli P, Fazio C, Neri A, Isola P, Sani S, Marelli P, Martinelli C, Mastrantonio P, Pompa MG. 2012. Cluster of invasive *Neisseria meningitidis* infections on a cruise ship, Italy, October 2012. Euro Surveill. 17:20336. http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20336.
- Simpson JT, Wong K, Jackman SD, Schein JE, Jones SJ, Birol I. 2009. ABySS: a parallel assembler for short read sequence data. Genome Res. 19:1117–1123. http://dx.doi.org/10.1101/gr.089532.108.
- Sommer DD, Delcher AL, Salzberg SL, Pop M. 2007. Minimus: a fast, lightweight genome assembler. BMC Bioinformatics 8:64. http:// dx.doi.org/10.1186/1471-2105-8-64.
- Jolley KA, Maiden MC. 2010. BIGSdb: scalable analysis of bacterial genome variation at the population level. BMC Bioinformatics 11:595. http://dx.doi.org/10.1186/1471-2105-11-595.